

# The Alignment of Screens

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# **Declaration**

I declare that this thesis is my own work  
and that it has not been submitted in any form  
for the award of a higher degree elsewhere.

Felipe Raglanti,

June 2016

# Abstract

This thesis makes a distinction between screen and surface. It proposes that an inquiry into screens includes, but is not limited to, the study of surfaces. Screens and screening practices are about doing both divisions and vision. The habit of reducing screens to the display neglects their capacity to emplace separations (think of folding screens). In this thesis an investigation of screens becomes a matter of asking how surfaces and the gaps in between them articulate alignments of people and things with displays that, in practice, always leave something out of sight. Rather than losing touch with screens by reducing them to surfaces, in other words, I am interested in alternative screen configurations. For this task I sketch an approach that touches on screens through the figures of lines, surfaces, textures, folds, knots and cuts. Lines help me to make the case for thinking about screens as alignments. I then ask what kinds of observers emerge from reducing screens to single or digital surfaces. I trace that concern with Google Glass, a pair of “smartglasses” with a transparent display. To distinguish between screen and surface I suggest, through a study of biodetection and assistance dogs, how to qualify or texture screens within webs of relations. I further outline, with snapshots of my workplace and two screens named Vig and Ben, two modes of touching or un/en/folding their locations. Finally, with knots and cuts, I underline the unfolding of self checkouts in supermarkets, and the enfolding of automated tellers outside banks. All of these reconfigurations experiment with screens by moving sideways in order to approach their displays laterally, and make visible their (ab)use by those in power. This method is a way of grasping the embodiment and the materiality of screens, while responding to the practices, agencies, and affects aligned around, through, and away from their displays.

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## **Chapter 1. Moving Sideways**

Late in December of 2014, the National Geographic Channel's series "Crowd Control" screened an episode on the dangers of walking and texting with smart phones on the street.<sup>1</sup> It addressed, in the mode of an experimental reportage of population behaviour, the reduction of peripheral vision of people walking and texting (National Geographic 2014). With some funky background music, the show begins by proposing that people who walk and text are clueless regarding their surroundings. As a test to support this assertion the host introduces us to Joe, a person wearing a gorilla costume who walks around the streets in Washington DC, wearing dark glasses, eating bananas, and reading a newspaper. Joe appears to put bystanders into a public situation articulated as an exercise, to distinguish between those who notice him and those who don't. So people walking by allegedly fail to see Joe, as they seem too preoccupied with their screens.

This dissertation is also about how people may miss what is around and away from the display of screens. It is less concerned, however, with walking and texting. Attending to their surroundings while walking and texting entails a risk that people seem to manage, I think, by iteratively looking at the display and around their smart phones, juggling with the screen and the street, switching their attention between these surfaces.<sup>2</sup> Only when that practice fails people do seem problematically to lose their grasp of what lies beyond their displays.<sup>3</sup> This thesis is about

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<sup>1</sup> <http://channel.nationalgeographic.com/crowd-control/videos/walking-while-texting/> (last accessed 08/01/16)

<sup>2</sup> I do not mean surface as an abstract plane beyond the screen, but simply that attending to the surfaces situated around the display of the screen, like the pavement of the street and the colours of the traffic lights, matters for walking and texting.

<sup>3</sup> Breakdowns of action with screens are generative for becoming aware of what is around and away from their displays; a sound, for example, can redirect people's attention around them. But one may also bump into other people and things, which is what seems risky about text-walking: people can break their bodies. The expression "juggling" means to attend around, through, and away from screens, an attempt to grasp both their flows and breakdowns.

that: staying with the trouble of grasping screens by considering what is beyond their displays. Rather than failure to notice one's surroundings, the analytical problem is losing touch with screens by reducing them to singular or digital displays. Here we will consider an alternative approach to screens, one that pays attention to displays but also aims to grasp in complementary ways what comprises the screen beyond the display.

What is a screen? A Google search ramifies this question in all sorts of directions. An interesting report posted early in 2016, on the Samsung company website for mobile devices, informs us that this year the market for TV displays may change.<sup>4</sup> Quoting the journal "Korea Times",<sup>5</sup> the article states that LG and Samsung, the giant South Korean manufacturers that dominate the TV display industry, will reduce their production to prevent operating losses against their Chinese competitors. In another search result, a piece by the popular website mashable.com,<sup>6</sup> we are told more about the histories of screens, including TVs. The website illustrates the creation, application, and variation of screening components and practices. These range from the use of cathode ray tubes (CRT), light emitting diodes (LED), or liquid-crystals (LCD) to plasma (seen as the foundational materials for television and computer displays); to the popularisation of touch-screens, high definition, and three dimensional image devices; and finally the prediction of future screen technologies that feature virtual realities as well as curved, flexible displays.

This is all intriguing, but I am struck that these online stories seem to define screens just as displays. The trouble in confusing screens with displays is the blind spot that such viewpoint articulates. By conflating displays with screens one can miss what screens leave out of sight. Instead, looking beyond the display allows us to grasp what screens separate or divide, and what

<sup>4</sup> <http://www.sammobile.com/2016/01/04/samsung-display-and-lg-display-to-cut-down-on-production-this-year/> (last accessed 01/08/16)

<sup>5</sup> [http://www.koreatimes.co.kr/www/news/tech/2016/01/133\\_194425.html](http://www.koreatimes.co.kr/www/news/tech/2016/01/133_194425.html) (last accessed 08/01/16)

<sup>6</sup> [http://mashable.com/2015/01/06/screen-display-tech-ces/#\\_gW1k0Gwkkql](http://mashable.com/2015/01/06/screen-display-tech-ces/#_gW1k0Gwkkql) (last accessed 01/02/16)

they sometimes hide from view. This is a mundane matter as it touches all sorts of screens and screening activities. Why undertake a study of screens? In the middle of a decade when screens appear relentlessly to demand the attention of people, and things are increasingly equipped with them, the point is to sketch a method to grasp screens less as objects that absorb time, energy, or desire, and more as powerful companions that rearticulate practices, agencies, and affects. The method advocates moving sideways from the concentration of attention, the extraction of values, and the exploitation of people and things touched by screens. This is not a normative but an open-ended, contingent, situated inquiry into screens, composed by grasping their empirical, material and semiotic relations with people and things.

## Screenness

I have worked with screens myself during the writing of this thesis, in different places. I have taken photos in public squares with my phone or sat on the floor of a packed train to scribble my ideas. Today I write this in the living room of my shared house, in front of my laptop screen, on a Tuesday morning. The lights of the room are off. I set the brightness of the display low to test how the screenness of this screen partly relies on the materials of the laptop, showing this line with a specific brightness and resolution, a luminous intensity and granularity of pixels that my older screens in the office cannot reproduce. I may also consider how the screenness of this screen depends on the materials of the living room. For instance the pale daylight shining through the window may be filtered out by closing the curtains, changing how I perceive the screen. The screenness of the screen in this sense rests on heterogeneous materials. Note that some of them are framed as on screen, while some of them are screened out. Screenness I want to suggest is a twofold act. Screens screen/out. The screen's display brings something into view and leaves something out of sight.

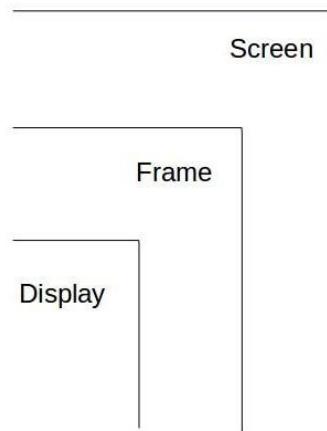
Screenness relates to all sorts of framing activities. Let's think about this with a clip<sup>7</sup> of Michael Jackson's entrance at the Super Bowl in 1993 (a popular sports event, the championship game of the U.S National Football League, where pop stars like Jackson feature as mid-time entertainment). The framing of his act is embedded in a short television clip, which is in itself another kind of framing. The camera first pans over the audience and zooms in on a giant screen mounted on the wall of the stadium. The screen, remaining black for a second, suddenly flashes silver lights to introduce Jackson on screen. He makes his signature dance-kick-move and then disappears from view, only to reappear in flesh and bone on top of the frame of the display. Here Jackson's clip is helpful to address screens, frames, and displays. What I mean when I say the screen's display (or simply display) is everything within the frame of a screen. In the case of the television clip the show or display first took place within the frame of the screen of the stadium. Frames are quite literally for me the material enclosing of what screens display. Frames draw attention to the screen's display – a move that enacts the selection of something specific that is brought into view and something else that is left out of sight – insofar the focus remains on the screen. That is the twofold act of screens, and what we learn with Jackson's clip is that what a screen brings into view and leaves out of sight may be dynamic. What screens display or make present on screen may become manifestly absent – or made present off screen in cases such as Jackson's clip.

This way of grasping the frame of screens borrows the distinction between presence and manifest absence from John Law's method assemblage (2004: 14, 42, 84). Methods for Law are enactments that construct knowledges by assembling or performing the realities under scrutiny. Methods are as partial and situated as the knowledges and realities they co-produce (2004: 68, 83, see also Haraway 1988, Strathern 1991). How does this help to grasp screens? Note that Law is

<sup>7</sup> <http://i.imgur.com/J6gXUqB.gifv> (last accessed 09/2/16)

suggesting that we take knowledge as enactment instead of representation,<sup>8</sup> so in the case of studying screens or employing screens for knowledge practices, what is brought into view on screens or through their displays should not be framed as a representation, but as the result of a bundle of “ramifying relations that generate presence, manifest absence, and Otherness” (Law 2004:42). In this sense Law provides a distinction with which to grasp the frame of the big screen in Jackson's clip, for example. In the clip the frame first helps him to come into view on screen (to become present through the display) and then to become manifestly absent from it in order to reappear on top of the frame. What about Otherness? Here we may let loose the frame of the screen to grasp what the display leaves out of sight. Presence and manifest absence may happen through and around the display of screens – but Otherness is a kind of absence that is not manifest, something that is completely left out of sight, although it remains necessary, in the case of screens, for what is brought into view. The walls of the stadium in the clip, for instance, or the infrastructure required for the screen to take part of the history, politics, and economics of Jackson's constitution as a celebrity. The distinction between screen, frame, and display can be drawn in this way:<sup>9</sup>

**Figure 0.** Display, frame, and screen



<sup>8</sup> “And it is the word ‘practice’ that is the key. If new realities ‘out-there’ and new knowledge of those realities ‘in-here’ are to be created, then practices that can cope with a hinterland of pre-existing social and material realities also have to be built up and sustained” (Law 2004:13).

<sup>9</sup> In this drawing “distinction is perfect continence” (Spencer Brown 1972:1). The display is contained by the frame contained by the screen.

## Embodiments

I have suggested so far that the screenness of screens depends on materials, bodies, and relations of people and things; these generate presence, manifest absence, and Otherness around, through, and away from the frames and displays of screens. This way of thinking about screens echoes various aspects of other approaches to screens in the field in which I position myself, Science and Technology Studies (STS). Screens have been approached in STS through highly diverse issues; for instance, financial markets (Knorr-Cetina & Bruegger 2000, 2002), protein folds (Myers 2008), and robotic rovers (Vertesi 2015). Karin Knorr-Cetina and Urs Bruegger in their work on the global microstructures of financial markets (2002) have paid careful attention to the screens of traders, stressing how their displays bring markets into being. On screen the market becomes something traders may locally attach themselves to; like people in supermarkets, the financial market becomes through the display an object of attachment (2000). This means that traders “strap themselves to their seats to bring up their screens” (Knorr-Cetina & Bruegger 2000:146), which become the “medium of existence” of the market (Knorr-Cetina & Bruegger 2000:146), insofar as traders remain glued to the display, “their body and the screen world melting together in what appears to be a total immersion in the actions in which they are taking part” (Knorr-Cetina & Bruegger 2000:146).<sup>10</sup>

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<sup>10</sup> Screens, in turn, encapsulate the market on screen. Enveloped within the frame of their displays, the market exist for traders at work, following Knorr-Cetina and Bruegger, “only on screen, where it comes as close as one can get to the ethnomet hodological sense of a locally produced phenomenon” (2000:146). At the same time the authors affirm that “the screens themselves are of course global rather than local” (2000:146). They propose taking the screen as representing a faceless global community of participants, engaged in “real-time” exchanges. And “the question to ask is whether the idea of embeddedness can be extended to global domains whose participants are not, as in traditional communities, in one another’s physical response presence and represent anonymous aggregates” (Knorr-Cetina and Bruegger 2000:161). As emphasized above, here we may move away from representation – while still agreeing with both authors on how “temporal mechanisms, and the common orientation of participants to an object on screen, may constitute a basis for a postsocial form of ‘intersubjectivity’” (Knorr-Cetina and Bruegger 2000:161). We may specify that screens appear global because what is made present on screen travels within a network of displays that brings the financial market into view. And what the screens leave out of sight either as manifest absence or Otherness can be grasped as a local or global extension of this market embedded on the screen of the traders.

Like Knorr-Cetina and Bruegger, Natasha Myers considers what is made present on the screen; in her case, with crystallographers sculpting “embodied models alongside the digital renderings they craft onscreen” (2008:163). Noting how chemists articulate their bodies to figure out processes of protein folding, she argues that digital models of protein structure “acquire a materiality and tangibility through their manipulation onscreen” (2008:178). So Myers shows us that the “in between” of a screen is always an embodiment. Screens render things present and absent in fleshy ways. Specifying the body-work of Diane, a participant in Myers' study, she describes how Diane's gesticulations carve out “the space of the computer screen [...] With her hands clasped and pulsing around invisible objects, she conveys the density and textures of the molecules, and their inter-molecular associations, while in the open, gestural space in front of her she builds a model ‘onscreen’” (2008:178). Janet Vertesi provides another tangible example of screen embodiment in her work on Seeing Like a Rover (2012, 2015). From the point of view of those navigating these robotic probes – deployed by the US National Space Agency (NASA) – Vertesi unpacks the body-work of image planning (2015:164), that is using photos to see like a rover in order to guide the robot's movements on Mars. Telling us about Liz, a participant in Vertesi's study, she details her grasp of the rover. “Right here [touches chest] is the front of the rover, my magnets are right here [raises head, touches base of her neck], and my shoulders [touches shoulders] are the front of the solar panels, and that's [leans forward, splays both arms out behind her at forty-five degrees] the rest of it” (2015:164). Liz fleshes out the rover from images on screen.

Matters of screen embodiment have been also a concern for authors interested in digital identity and ontology, like Sherry Turkle and Katherine Hayles. In *Life On The Screen* Turkle (1995) invites us into the worlds of those who construct their identities online. Turkle's focus on the screen traces the connections between people's selves and simulation, and the consequences of

“taking things at interface value” (1995:19-26, 102-124). In particular her approach to screens captures people facing displays when framed as “interfaces” that would make it possible to “step through the looking glass” (1995:9) into virtual cyberspace worlds, which is a story rooted in science and fiction. From cyberspace Turkle unpacks how people shape multiple fluid selves constituted in interaction (Turkle 1995:15). Drawing on a similar trope, that of human-machine cyborgs, Hayles in *How We Became Posthuman* (1999) looked at “posthuman” embodiments of technology, the more-than-human meshing of organisms and machines. For Hayles, posthuman metaphors privilege “informational pattern over material instantiation, so that embodiment in a biological substrate is seen as an accident of history rather than an inevitability of life” (1999:2) which correlates to perspectives found in cybernetics, information theory, and cognitive science among other disciplines. The posthuman divides and reattaches “the material body that exists on one side of the screen and the computer simulacra that seem to create a space inside the screen” (Hayles 1999:20). Such screens would allow people to dwell in cyberspace, to leave behind “unoccupied shells” (Hayles 1999:38), by stepping over a boundary that splits actuality from virtuality (Hayles 1999:258).

## Alignments

Screens are about division as much as they are about vision, something that is difficult to grasp when one is into the habit of only looking at screens as digital displays. Instead, take for example how folding screens divide one place from another, or how firescreens are meant to protect. Screens in their material and allegorical variety have been extensively explored within Media and Cultural Studies. This field has detailed screens, for instance, as surfaces for projection in the emergence of cinema (Musser 1994), and as “virtual windows” used widely in art, architecture, television, and computing (Friedberg 2006). It has also explored the diversity of

screens and screening artefacts [devices such as cameras obscuras, panoramas, magic lanterns, shadow theatres, diaphanoramas, stereoscopes or peeping boxes (Huhtamo 2004)] by suggesting archaeological and genealogical methodologies (Manovich 1995, Gere 2006) and the historical unravelling of “screen making” practices (Musser 1994:15). Through careful attention to screen embodiments, these studies have also raised questions and proposed suggestions to account for screen agency – Erkki Huhtamo for instance has encouraged researchers to pay attention to the “shifts of perception between nothing less than ontological realms that take place when [people] move their gaze from the screen to other humans, to the surrounding landscape, to another screen, and back again in rapid succession” (2012:144). We learn with them that screens are difficult to look at. Never a neutral medium of presenting information, screens for Lev Manovich (1995) are aggressive. They can filter, screen out, take over, and render non-existent what is framed outside their displays.

When one approaches what a screen aligns, in an encounter of people and things with a display that always places something else out of sight, the enactment of such screen alignment envelops what Lucas Introna and Fernando Iharco have studied, in phenomenological ways, as people's experience of screens: the “intentional orientation that conditions our engagement with certain surfaces in as much as we comport ourselves towards them as screens” (2006:58). This attention to the phenomenology of screens and screenness (Introna and Iharco 2004, 2006, 2011) has benefited from grasping how screens attract attention, specially in cinema (Sobchack 1992, 1994, 1997; Marks 2000). “What is seen on the screen by the seeing that is the film has a texture and solidity. This is a vision that knows what it is to touch things in the world, that understands materiality [...] It not only understands the world haptically but also proxemically” writes Vivian Sobchack (1992:133). Stressing, on the other hand, the (hi)stories and (public) enactments of images on screen, Media and Cultural Studies scholars have investigated screens in scientific

filming (Cartwright 1995), information media (Arnold 2002), organizational practices (Styhre 2013), or urban spaces (Krajina 2009, Simone 2012).

Novel ways of studying what I name screen alignments, of attending to screens (Ziewitz 2011) and encountering screenness, have surfaced from the research of STS scholars into how “screens play an increasingly central role in a wide range of human practices” (Winthereik, Lutz, Suchman & Verran 2011:1). Once again writing against grasping screens as passive, inactive spectators, they suggest taking screens as “participants in the construction of vision and action” (Winthereik, Lutz, Suchman & Verran 2011:1). Because screens in this sense help to organize everyday interactions by aligning people and things with displays, the lesson entails learning to account for the dis/continuous ways in which screens can be outlined as “cutting off particular views and viewers as well as connecting them. Screens stretch human interactions in time and space, and produce new spaces and forms of interaction” (Winthereik, Lutz, Suchman & Verran 2011:1). In this sense, the authors propose that to grasp how screens make people and things in/visible or present and absent in relation to one another, we need a relational ontology that can be traced by taking screens as indexes (ordering devices), or by unpacking their capacities to configure bodies and practices. Seeing screens as ordering devices that distribute agencies helped scholars to study screening practices in cases of tax regulation (Boll 2011), school planning (Ratner 2011), and research collaboration (Bjørn 2011). And attending to reconfigurations of their (digital) displays afforded the possibility to dis/entangle the screen from/to maps of urban disasters (Petersen 2011) and transport systems (Valderrama 2011). These approaches aptly encourage the generation of new accountabilities and responsibilities, the latter by looking well “beyond the physical screen for reconfigurations in the wider context” (Winthereik, Lutz, Suchman & Verran 2011:2). Screens in these stories are encountered along with the answerability of “doing ethnography on screens and screenness” (Winthereik, Lutz, Suchman & Verran 2011:2).

I have been inspired to think responsibly of matters of screen alignments, and to stay in touch with their materiality, by Donna Haraway and Karen Barad's work. These feminist STS scholars and SF activists<sup>11</sup> troubled and changed, with the indivisibility of the material and the semiotic,<sup>12</sup> my former approach to the cultural and the technological, the social and the natural, based on the observation of society as an autopoietic system of communication (Luhmann 1995, 2012). In this theory as in others in sociology, materiality appears somehow backgrounded in communicational processes. It enters the scene in the coupling of the psychic and social systems, for example, as a fleshy symbiotic element; and also within social systems, for instance as mass media materiality acquires the shape of infrastructure (Luhmann 2000a:3).<sup>13</sup> Haraway's practice couldn't be more different; in her queer accounts of objects and subjects of (scientific) knowledge, people and things are always situated simultaneously as material and semiotic, and no relational process is exclusively symbolic. Her material-semiotic actors can be seen as generative nodes of natural and social relations, whose open-ended boundaries "materialize in social interaction" (Haraway 1991:208). Likewise, Barad has proposed that "existence is not an individual affair. Individuals do not preexist their interactions; rather, individuals emerge through and as part of their entangled intra-relating" (2007:ix). Her approach underlines the inseparability of epistemology, ontology, and ethics (Barad 2007:26); and the inevitability of interfering with and through the making of the world.

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<sup>11</sup> Haraway's SF research practice conjoins Science Fact, Speculative Fabulation, String Figures, Science Fiction, So Far...

<sup>12</sup> "Matter and meaning are not separate elements. They are inextricably fused together, and no event, no matter how energetic, can tear them asunder" (Barad 2007:3).

<sup>13</sup> Luhmann comes closer to a material-semiotic reading of the social in the system of art, where materials become quasi-objects (2000b:47).

## **Storytelling**

Drawing from this literature that appends materiality to screenness and embodiment to screens, and tracing the material agencies of screens as alignments of people and things with displays that iteratively bring something into view and leave something out of sight, I begin to compose the material-semiotic framework for a method to study screens, by grasping how such alignments create presence and absence around, through, and away from their displays. As concisely put by Law, material-semiotics “privileges partial perspective, split vision and situated knowledge, arguing both that there is no escape from location and that identities, locations of knowledge, politics, and action are heterogeneous and irreducible rather than being coherent” (2004:160).

Insofar as matters for Haraway take multiple rather than singular, or many modes of “becoming with” which are not translatable (or reducible) to one another, she reminds us with Marilyn Strathern that it matters for partially connected issues how thoughts think thoughts, knowledges know knowledges, relations relate relations, worlds world worlds, and stories tell stories (2015:160).<sup>14</sup> If screens in their own ways are heterogeneous and irreducible to their displays, then it matters which thoughts, knowledges, relations, and worlds may flourish with stories of screens. Because storytelling matters, the chapters of the dissertation tell stories that attempt to make a difference between screens and displays, and also to experiment with that difference.

This storytelling exploration first took the shape of a portfolio of screens to collect interesting cases. Along the way some of these screens were discarded. Many were cases of “cutting-edge” screening technologies. They were cutting off – or so it seemed to me – the views

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<sup>14</sup> See also <http://www.youtube.com/watch?v=Z1uTVnhIHS8&t=1259> (last accessed 11/03/16)

and viewers of screens that seemed interesting not only because of their displays. Then this exploration of screens took the shape of writing experiments, of shaping voices to talk about screens. This resonated also with a kind of inquiry that puts rhetoric and reality or style and substance together, by writing without splitting mind and matter or facts and fictions (Lynch 2012:465). Finally this exploration took the shape of a method or way of touching and being touched by screens.

Each chapter experiments with screens by writing about them in a specific situation read with a different figure, so we'll come back in the last chapter to review the method assembled throughout the thesis. Moving sideways is the gesture these experiments nurture. Approaching screens by moving sideways is a matter of paying attention to the ways in which screens align people and things with displays. To this extent the gesture may be attuned for moving sideways from particular people and things when encountering screens, but such attunement in turn is an experimental matter that can go wrong. Moving sideways is not easy because screens are tricky. Nevertheless, as we go on we'll attempt to avoid the extraction, concentration, and exploitation of the attention and values of people and things. This is not only because screens relentlessly demand more attention from people, and things are increasingly equipped with them, but also because screens are helping to make worryingly mundane the collection of valuable information (which points to issues of privacy), their demands on space and time (which leads to matters of mobility), and the abuse of screens by those in power. Or at least that is my worry. All chapters provide a figure to approach screens by moving sideways: (2) lines, (3) surfaces, (4) textures, (5) folds, (6) knots and (7) cuts.

## Chapters

There is more than one way of putting these figures together. Below I will outline the chapters, but if this comes across, perhaps, as too abstract, readers can try to jump to the last chapter, where we will review in detail how moving sideways helps to approach screens. Once there, it is possible to continue anywhere else in the dissertation. I was inspired to make the structure porous by a novel from Julio Cortazar named “Hopscotch”. The plot of this book is assembled in an open-ended way, and Cortazar tells readers at the beginning that they can hop, or jump through the chapters, to build different readings. I invite readers to pick alternative routes as well. This won't change the argument. What it adds is a sense of how the figures can work together in multiple ways to study screens. So, one may read the stories straightforwardly in order to learn step-by-step how to approach screens sideways. And those inclined to take another route may use this table of instructions, or come up with their own directions:

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1 – 8 – 5 – 2 – 7 – 3 – 6 – 4

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Chapter 2 makes the case for reading screens with lines. To grasp screens in terms of alignments we start with lines. What are lines? We will approach them by drawing lines and unpacking them from a few pictures taken during my summer walks to campus. Tim Ingold's taxonomy of lines (2007) becomes helpful to distinguish different lines that participate in the alignment of the surfaces and/or gaps of screens. With lines I will grasp displays as a part of screens.

In this way I will take lines as material-semiotic actors and stress that boundary lines

particularly help to organize action and relations. Attending to boundary lines as specialized in sorting out people and things, I will speculatively begin to move sideways from screens, by underlining how practices of exploitation overall tend to circulate around centres of calculation (Latour 1987) and coordination (Suchman 2011). Such practices expand lines shaped in these centres.

Chapter 3 focuses on surfaces and discusses the kinds of observers that emerge from reducing screens to single digital surfaces. I will grasp surfaces with Google Glass, a pair of “smartglasses” with a transparent screen that I detail with a marketing video. This promotion displays a profitable user who spends “One Day” with Glass. It portrays this imagined user in situations where he is always looking through Glass. Actions in these situations unsurprisingly never break down. Everything appears as timely, configured for a user who moves smoothly through a city.

Contrasting this story, I will picture a day with Glass with the absent breakdowns made visible, by reading a video response that makes these present through a satiric version. This depicts how actions “augmented” by the screen remain fragile achievements. Adding some parody, the user again looking always through Glass burns himself with hot water, and gets run over by a car because of Glass. To shake off the tendency to conflate screens with surfaces and to configure displays made to profit from people, we will learn from a dog called Emma how to juggle with screens.

Chapter 4 translates with the help of more dogs the lesson of juggling with screens into practice. Dogs will help us to grasp screens as alignments of people and things with displays. Focusing on screening practices of Medical Detection Dogs we will learn in the contact zone

(Haraway 2008) how to follow people and things, moving around, through, and away from a display of samples. We will detail the work of a playful screening practice tuned for cancer detection, where humans and dogs align with screens the textures or qualities of their webs of relations (Law and Lien 2013).

Studying screens with Medical Detection Dogs will also bring us closer to the field of Animal-Computer Interaction (ACI). I draw from my encounters with ACI practitioners during fieldwork, and the research of my friend Charlotte Robinson, to show with a prototype of an emergency phone for assistance dogs how screens that take shape in ACI can help animals to qualify their webs of relation, by orchestrating their alignments or arranging their architextures (Law and Lien 2013).

Chapter 5 further suggests with snapshots of my workplace and two computer screens I named Vig and Ben, that becoming in touch with screens is a matter of unfolding what their displays bring into view, and grasping what such alignment places out of sight by enfolding arrangements which are cut off for particular viewers. As Geoffrey Bowker (2012) notes, the allegory of the fold is useful in STS to remain mindful about boundary-work in technosciences. With folds I trace the boundaries of my workplace, unfolded through Vig and Ben around my shared office.

Then complementing such way of approaching my alignments with Vig and Ben, as a method to assemble or unfold presence, manifest absence, and Otherness, we will add with Haraway's apparatuses of bodily production (1991) another mode of grasping alignments, that makes present the “hinterland of relations” (Law 2004) enfolded out of sight, away from the screen's display. Both methods to study screens attend to the passages of stories that unfold

significant alignments, and arrangements that enfold spatio-temporal patterns of inclusion and exclusion.

In chapter 6 I will touch on screens and calculative actions with self checkouts in a supermarket. The chapter highlights, with the material-semiotic knots of a mnemonic artefact named Khipu (an Inca accessory used for accounting), the timings of purchases that people choreograph with things on the shopping floor and the collective devices (Callon and Muniesa 2005) that self checkouts align in supermarkets. I briefly compare supermarket purchases with online grocery shopping.

We will work with Mikhail Bakhtin's concept of chronotope (1982), an amalgamation of time and space or "TimeSpace" (May and Thrift 2001), to distinguish ways of timing acts of calculations, through breakdowns of different moments of movement and the re-attachments of people and things to the collective devices of a supermarket. From one bundle to another, the courses of action with self checkouts knot or put together the shopping floor, the queue, the purchase point, and the shopper's exit passage; a patchwork that can be realigned for different supermarkets.

In chapter 7 we will grapple with screens and financial actions with automated tellers. Underlining how automated tellers also act as vaults or safes, I will grasp the spacings of the enveloped passages that people and things cut through the protections of the cash point. This approach refigures such passage of access with the walls of the pukara, a fortress-like toponym also borrowed from the Incas. In this way I will attempt to cut the automated teller from the personal touch and the neoliberal optics (Hayward 2013) that banks use to disclose people as clients.

For this task I will underline with the use of topological thinking in social studies, to grasp how people and things make a place for, and align specific locations with, automated tellers. I will sketch topologically how the alignment of people and things with the machine's display carves out the kind of places that secure automated tellers in everyday life. This refiguration decenters the lines of visibility, utterance, and force (Deleuze 2007) of automated tellers, and modifies their dynamics of change by suggesting a way of passing money without banks.

Chapter 8 hops through the dissertation and discusses how this study of screens has composed stories and experimented with modes of grasping screens, sketching a lateral way to approach their alignment of people and things with displays, in order to reconfigure screens by moving sideways.

## **Chapter 2.** Lines on the road

Anna Tsing has written wonderfully about mushrooms (2012:141). She says that wandering and love of mushrooms engender each other. By this she means that picking up mushrooms comes with the pleasure and contemplation of the speed of walking the earth. Bumping into and so collecting mushrooms entails the delights of bounties which are not products of human labour (2012:141). Stepping along a path in this sense guides her future walks, so she tells us that “delight makes an impression: an impression of place. The very excitement of my senses commits to memory the suite of colours and scents, the angle of the light, the scratching briars, the solid placement of this tree, and the rise of the hill before me. Many times, wandering, I have suddenly remembered every stump and hollow of the spot on which I stood — through the mushrooms I once encountered there” (2012:142). I think her relating to mushrooms is very telling of people’s fingery engagement with things, including screens. Take digital icons for instance,<sup>15</sup> as things that screens bring into view with “all the pleasures of the unasked for and the unexpected” (2012:142). Inspired by Tsing’s sense of “encountering” mushrooms, in this chapter I suggest with photographs from my walks to Lancaster University a way to attend with lines to how screens align people and things in practice. Thinking with lines as material-semiotic actors (Haraway 1988:588) that interact to create surfaces, I offer an impression of traces and threads as the building blocks of screening practices. I propose to address what screens materialize, indeed what counts as a screen, by thinking about them as practical alignments of the surfaces of people and things during an encounter.

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<sup>15</sup> See chapter 5

## Lines

What do lines and surfaces tell us about screens? Tim Ingold initially suggests, for example, that “every thing is a parliament of lines” (2007:5), a claim that seems helpful to define people and things as gatherings of enveloped bodily volumes: as alignments that materialize, enact, or enfold people and things. Following Ingold “to study both people and things is to study the lines they are made of” (2007:6). But what are lines made of? Let's approach them empirically. Draw a set of points on a surface, join them with parallel or crisscrossed strokes, and you get a kind of line that Ingold calls a trace. According to his taxonomy, a trace is an enduring mark left in or on a surface by a continuous movement (2007:43). The gesture appears with striking frequency in everyday life. For instance, traces might be left by the movement of feet on a patch of land, by doodling with chalk on a blackboard, by folding an origami. Ingold further differentiates traces into two categories: additive and reductive. While the former adds an extra layer to leave a trace on a surface, the latter removes a material from the surface to leave a trace. Then painting with graphite or watercolours and writing with ink or lemon juice creates lines that neatly fit in the class of additive traces. Crawling through a desert or a swamp and navigating through a jungle or an ocean are traced lines that nicely qualify as reductive.<sup>16</sup> Besides traces, Ingold thinks of threads as another kind of line. These are filaments that when put together “in the air” make nodes. As Ingold writes:

At a relatively microscopic level threads have surfaces; however, they are not drawn on surfaces. Here are some common examples: a ball of wool, a skein of yarn, a necklace, a cat's cradle, a hammock, a fishing-net, a ship's rigging, a washing line, a plumb-line, an electrical circuit, telephone lines, violin strings, the barbed-wire fence, the tightrope, the

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<sup>16</sup> Folding origamis makes lines not by adding or reducing a solid material, it leaves creases via bending the surface (Ingold 2007:44).

suspension bridge (2007:41).

Note while threading can be taken as a specific anthropological practice, threads are made not just by humans. So an attentive walk through the countryside, Ingold suggests, discloses the thread-like lines hidden underground in the shape of roots, rhizomes and fungal mycelia, or above on the veins of leaves and the sprouts and shoots of plants. Let's apply these classes and cases of Ingold's taxonomy by looking at a series of photographs of my summer walks to my department in Lancaster University. Here I note a winding path that is aligned or articulated by a set of surfaces. They trace on the road, on the signpost, and on these fences the boundaries dividing the path as a public place and the surrounding private houses (figure 1). See also the significance of the line in the centre. It helpfully signals the point where the path disappears, as well as who – pedestrians or bikes – should take which side to walk or ride the road. This line put in the centre meshes the organization and the mechanization of the path, and at the same time it differentiates the expected positions of human organisms and bicycle mechanisms travelling along the road. During my walks, I saw people and things regularly staying within and travelling along the places designates by these figures. The line in the centre is material and semiotic, a material-semiotic actor on the road, informing along the way the tracing of parallel or peripheral lines (figure 2) that also bound the paths meant for bikes or pedestrians.

Squirrels, rabbits, dogs and children without leashes have no respect for such linear subtleties. When you suddenly hear around here the brakes of a bike, it is probably because someone walked over the line traced in the centre. This brings to mind Lucy Suchman's ethnomethodological reminder that "order is in the details" (2011:24), and helps me to foreground again the landscapes borrowed from Tsing's foraging:

**Figure 1.** Path to campus  
(photograph by author)



**Figure 2.** Parallel traces  
(photograph by author)



The familiar places of foraging do not require territorial exclusivity; other beings — human and otherwise — learn them too. Their expansive and overlapping geographies resist common models, which divide the world into ‘your space’ and ‘mine.’ Furthermore, foragers nurture landscapes — with their multiple residents and visitors — rather than single species (Tsing 2012:142).

Inspired by this delightful invitation to walk the earth, and bumping into details that escape pre-ordered arrangements, I zoom my biomechanical eye to focus on the lines at the margin of this path. I turn my shoulders parallel to the road, and face a fence along the way where unruly edges appear (Tsing 2012). I grasp in the allegory and the mess of these margins the meshings of people and things that may flourish around, through, and away from all sorts of screens. Peripheries like centres are full of gestures, details, and stories. Note the plant’s shoots and sprouts growing around the matrix-like shape of the fence (figure 3) as well as through its

metallic threads (figure 4). In this manner, by turning sideways along the road, traces can become threads, and by facing the road again, threads can become traces. “It is through the transformation of threads into traces, I argue, that surfaces are brought into being. And conversely, it is through the transformation of traces into threads that surfaces are dissolved” (Ingold 2007:52).

**Figure 3.** Shoots and sprouts  
(photograph by author)



**Figure 4.** Metallic threads  
(photograph by author)



## Surfaces

What I did to traces and threads by turning sideways is something I may repeat by constantly ripping surfaces apart to make threads, and then by densely putting these threads together again to create surfaces and traces. Likewise, if people and things are made of lines, they may be iteratively ripped apart and then put together again, within an infinite loop of creation and destruction of enveloped entities, enfolding and unfolding them through the

transformation of threads into traces and the dissolution of traces into threads. This linear becoming then highlights the promiscuously fleshy input of folding bodily volumes. As registered in the photographs, the figuration of entities entails threading and tracing the heterogeneous surfaces of enveloped volumes becoming parts of people and things.<sup>17</sup> Ingold addresses this when he writes about making cuts, cracks and creases (2007:44-47). Such ruptures have the capacity to make and to dissolve surfaces says Ingold, following Wassily Kandinsky (1982) and the example of the spade, cutting “the surface of the soil, as in an archaeological section, creating a new, vertical surface in the process” (Ingold 2007:45). Severing surfaces to make cuts, cracks, or creases plays a part in the loop of creation or destruction of enfolded bodily volumes. Cutting, cracking, or creasing people and things mediates their tracing and threading practices. Then cutting in this way “a sheet of material rather than the ground itself does not create a surface but divides the material: thus the dressmaker cuts lines in her material with scissors, as does the puzzle-maker with his jig-saw” (Ingold 2007:45).

Doing lines envelopes the maker, who becomes enfolded into the surfaces created through tracing practices, and dissolved through threading practices. For instance, Ingold presents the case of a labyrinth to trap the dead imagined by the Chukchi of north-eastern Siberia, as it appears in the monograph by Waldemar Bogoras. This maze in the underworld stretches through the earth rather than on it. Unlike the famous Cretan labyrinth traced by Daedalus (that Theseus resolved by means of a thread), in this ghostly maze travellers are enclosed within the earth, in a medium that facilitates movement along its cracks and its crevices. This would insulate them, according to Ingold, from sensory contact with the surroundings. Like going online without attending to what lies around and away from the computer screen – this portrays “the very moment of going underground, of entering the

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<sup>17</sup> In other words, I am suggesting with lines how entities are figured as people and things in the making of surfaces.

labyrinth, [when] the surface itself disappears from sight” (2007:56). Similar to the transition from life to death, becoming digital has been seen as dissolving the fleshiness of surfaces (Hayles 1999).

Now that I have defined people and things as made of lines and sketched how they become enveloped by the surfaces they create and dissolve, let's see how another line from Ingold's taxonomy – the ghost line – participates in the process (2007:47). Ghost lines are invisible threads made infinitely thin by endlessly ripping apart a surface. The ghost line becomes visible by transforming it into a thicker thread or a trace. For instance the lines satisfying the axioms of Euclidean geometry can be traced on paper, or the lines of a constellation of stars in the sky can be mapped. A ghost line plotted by such bijective<sup>18</sup> transformations becomes concrete in a practical way, and once abstracted into a specific situation, it may be seen as tracking the trajectories of people and things, tracing time-like curves.

The full scope of the process of creating or dissolving surfaces can be stated as a transformation that begins within two potentially endless extremes. On the one hand, an infinitely thin ghost line that becomes thicker. On the other, an infinitely dense surface that becomes thinner. If this process starts with a ghost line, to create a surface the line passes through the states of a point, a thread, a trace. To dissolve the surface, the process goes backwards and the trace passes through the states of a thread, a point, a ghost line. So, the making of specific surfaces entails the co-production of a bundle of lines, as traces make surfaces, threads texture them, creases bend them, cracks fracture them, cuts rip them apart, ghost lines create spaces in between them : : lines become worldly with other lines. More generally, world lines are a way to note and a code to take notes about a course of events.

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<sup>18</sup> Bijection in mathematics is way of enumerating a one-to-one correspondence between the elements of two sets.

Annotating their states, world lines may be effective as means to track sequential paths or trajectories.<sup>19</sup> Lines are also useful in calculus to approximate the slope of curved paths with straight traces. What lines do to other lines echoes the flexibility of bending and rectifying trajectories.

## Let there be more lines

A boundary remains stable when the line tracing its border or limit does not become something else. A limit depends on the becoming of its line, on the mode of being of its borderline, on how the border becomes worldly with other lines. Note before that we have already encountered a boundary line in the centre of the road. Constructing such a borderline is easy. Begin with an action that you aim to organize in a specific way by sorting out the actors in an arrangement. The line in the centre may be any line (thread, crease, ghost line, etc.) that is centred around such an arrangement, a line put “in between” the actors that orders people and things. This figure is useful to sketch lines that grow from centres, appearing anywhere by diffracting their ordering capacities through other lines, seizing their locations to shape an arrangement, to configure a practice, to order and discipline the actors, to make them be the people and things the line in the centre aims to sort out. I grasp more subtle details of this boundary line in chapter 7 by grasping it as knotting lines of visualization, utterance, and subjectivation between lines of force. Now let's define first how the line in the centre may become powerful by entangling the lines of people and things with centres of calculation and coordination.

The line in the centre becomes worldly by suturing trajectories of people or things;

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<sup>19</sup> For instance, the trajectory of “personal human events (with time and place as dimensions) that marks the history of a person — perhaps starting at the time and place of one's birth until one's death. The log book of a ship is a description of the ship's world line, as long as it contains a time tag attached to every position. The world line allows one to calculate the speed of the ship, given a measure of distance (a so-called metric) appropriate for the curved surface of the Earth” (Wikipedia's world line entry retrieved from [http://en.wikipedia.org/wiki/World\\_line](http://en.wikipedia.org/wiki/World_line)). At steady speed the world line traces a geodesic.

situating, stabilizing, and sanctioning the course of their events, pinpointing their actions by producing, positioning, and policing the states of their movement. A great example of the construction of a line in the centre is offered by Latour's take on Lapérouse's travels (1986), sailing for Louis XVI to improve his map of sea routes. According to Latour a network of relations between the people and things enrolled in Lapérouse's journey is what allows him to stabilize translation between the inscriptions on his map and the sites abroad. A network of relations makes it possible to situate 18<sup>th</sup> century Versailles in the centre of a circuit of transportation of vessels and a cycle of accumulation of goods. In this sense, the journey produces a circuit with a centre that aims to calculate a maritime route to maximize the accumulation of goods, and to sanction the circulation of people or things by policing their movements around the positions mapped by such centre of calculation. To sail this circuit's waters people and things have to become what Versailles wants them to be: means for the exploitation of a circuit. Note with Suchman's similar notion of a centre of coordination, we might sum up that Versailles was concerned, above all, "with problems of space and time" (2011:25).

Stabilized with the translations of Lapérouse's map, the trajectories across the circuit around this centre (Versailles) can be characterized as movements "from point to point, in sequence, as quickly as possible" (Ingold 2007:73). Such movements relate to an array of interconnected point-ports, aligned before setting out, and enacted by the trajectories of the vessels – a movement that meanders as little as possible from the sea route of Lapérouse. Contrast this kind of sailing with the movements of bodies that might diverge from those authorized by Versailles. Entities in open waters – not to mention underwater – may drift by sailing and swimming along a digressing path rather than across Lapérouse's route. Moving along would be a different kind of activity than moving across a trajectory. For Ingold "both

kinds of movement, along and across, may be described by lines, but they are lines of fundamentally different kinds. The line that goes along has, in Klee's terms, gone out for a walk. The line that goes across, by contrast, is a connector, linking a series of points arrayed in two-dimensional space" (2007:75). Ingold relates then moving across with transport and moving along with wayfaring; for him, transport is a form of movement that can be broken down in advance, into multiple spots on the way, then rejoined by a trajectory that reconnects these places. A wayfarer does not travel like this. She inhabits the duration of motion without rush, taking delight from the speed of walking the earth and sailing the sea. She trails as she goes along.

Moving along or across is a distinction that may inform too how people and things travelled on my way to university. As said above, the line in the centre sutured people and bicycles on the road, assigning a lane for each to move across the path. Their trajectories followed the line in the centre without trespassing the boundary it materializes; thus moving across the road bounds people and things within passages marked by the line in the centre. Surely the path works for transport purposes from town to campus and back, but people and things may move differently, obliquely (figure 5), laterally (figure 6). One may dismiss and reimagine this path by moving along the road, trailing around and eventually diverting away from the line in the centre.

Let's sum up then the displacement of people and things being wayfarers rather than subjects or objects of transport, by saying that shifting from travelling across to trailing along any worldly trajectory entails moving sideways from the line in the centre. This shift means avoiding the lines that may form part of centres of calculation and coordination, to release oneself from positions within a circuit, materialized by what I have called the line in the centre.

Instead of facing such lines diffracted by a centre, a point or orientation that fixes in advance “your” place and “mine”, stretching the line in the centre vertically as when people and things travel down or up the road, one may place oneself and others sideways, alongside the line in the centre, to face it as a bending horizon projected at infinity.

**Figure 5.** Oblique path  
(photograph by author)



**Figure 6.** Lateral path  
(photograph by author)



Moving sideways is an attempt to deactivate passages delineated by centres and peripheries. The attempt consists of finding ways to reflect on the meandering trails that may divert from lines that force people or things to become some fixed entities, for the distinct purposes of stabilizing ways of exploiting them. Moving along sideways enables attentive wayfarers to forage the infinities of lines diverting from the patterns of forces of centres of calculation and coordination. Rather than sorting out and screening people and things across the divides of these forces, by moving sideways one articulates shifts that disclose the materials and semiotics of alternatives to practices of calculation and coordination that attempt to define in advance what people and things are. Trajectories for alternative passages through such circuits

may be endlessly placed instead alongside the line in the centre, when imagined as a horizontal spectrum that bounds the positions of people and things in open-ended ways, aligning them on a projective plane that envelops their parallel trajectories, folding them as they trail along so as to articulate their movements.<sup>20</sup>

### (Re)aligning Screens

So what do lines and surfaces tell us about screens, if one aims to rearticulate the screening of people and things, across the passages aligned by centres of calculation and coordination? Gunther Kress considers (citing Skeat's Etymological Dictionary) that the word "screen" has two definitions and three broad meanings (2006:200). On the one hand, a screen is that which shelters from observation, a division or a partition. On the other, a screen is that which filters for an implied observer. The sense of screens as shelters means that they protect or conceal. Defining them as filters means they can select. The notion of selection for an observer particularly relates to the role of screens in visual practice, while screens as shelters from observation have a slightly different meaning. These screens afford a curious observer to ask, in particular, who or what is being separated from whom? Fire screens exemplify well this denotation of screens as partitions or divisions that shelter from observation (figure 7). Note in this figure that the screen, mounted on a wooden stand with a knitted image of a fruit bowl, conceals the fire from the observer. Computer screens, in contrast, are good examples of filters that display or select for the observer. They also resonate with Claude Shannon's theory of information (1949) or noise filtration and the canalization of signals through electromagnetic waves. In this sense, screens may be about both vision and division. They can reveal and

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<sup>20</sup> Placing passages to proceed by moving sideways is a tactic inspired by Michel de Certeau's practices of everyday life (1984: 91-110); de-centring forces of calculation and coordination nurtures the "multiform, resistance, tricky and stubborn procedures that elude discipline without being outside the field in which it is exercised" (de Certeau 1984: 96).

conceal.

**Figure 7.** Fire screen

(image taken from reddit.com)



**Figure 8.** Grating screen

(photograph by the author)



The sense of a screen as that which filters for an observer seems to aptly name the contemporary use of the screen as a surface for projection, as a display used in cinema, television, photography, or a display for an observer of the outputs of computing devices. Perhaps the German expression *Bildschirm* is a useful alternative word for computer screen, roughly meaning picture-shield, pointing to the screen's capacity both to reveal and conceal, something more evident in the Dutch term *sherm* (cover), and the Frankish word *skrank* (barrier). To move toward a reading of the screen as a picture-shield requires first that we grasp a sense of screening devices untied from computing machines – such as the fire or grating screens pictured in figures 7 and 8.

Note how figures 7 and 8 provide single-frame pictures of screens made with different kinds of lines. Figure 7 portrays a Victorian fire screen mounted on a stand.<sup>21</sup> The screen looks like a painting, made of densely webbed threads, framed with wood, stitched with traces that produce a surface. It protects from a fire and creates an image for an observer. It enfolds a person, not only because of her focus on the surface of the screen, but also because of her position in relation to the screen, separating her from the sparkling fire. If one turns around the screen for the image to face the fire, this double effect is lost. Surely fire screens mostly provide protection: they make sense as they align with, and so divide people from, the fire. Move the stand attached to this fire screen and you mess with the way it aligns people and things. But that appears to be hardly the case for the grating screen pictured in figure 8. Reposition the wheelbarrow and the alignment is preserved, the screen still acts as a filter mounted on the wheelbarrow. Grating screens are made of lines less densely threaded than Victorian fire screens. They mostly have parallel filaments neatly sorted out in matrix-like metallic shapes. This leaves holes in between the threads through which something may be selected and so brought into view, and something else may be left out of sight. So we may assume that this grating screen acts a sieve to filter sand and earth, to sort them out by screening the bigger stones which are brought into view on the surface, leaving the finer grains out of sight beneath it.

This preliminary reflection about screens suggests how their surfaces align people and things in open-ended ways. Screens tend to be associated with visual practices, but they also separate or divide people and things. Etymologically we may classify screens as that which shelters from an observation, and that which filters for an implied observer. Screens are about vision and division, revealing something and concealing something else. The surface of the screen tends to materialize both effects in practice, as one or the other or both may surface in action. Screening can be seen as a superficial effect, but screens may align people and things

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<sup>21</sup> There is another smaller and more modern fire screen aligned directly in front of the fire.

with gaps, rather than surfaces, in order to separate them – and this is key to distinguishing between surfaces and screens. Note that while in aligning the surfaces of people and things one might split them, by placing a surface between them, one might also separate them by making a gap. Such is the case when screening people into different groups, by articulating a gesture that divides them from one another. Screens become defined in practice as alignments of people and things with displays that always leave something out of sight. This entails studying screens in action, but it does not reduce screens to the study of surfaces. It expands what is unique about them, to the study of people and things aligned with gaps and/or surfaces that articulate vision and divisions.

I have specified lines here as the building blocks of the surfaces of screens, and defined screens as alignments of people and things with displays. Screens are mundane arrangements that may simultaneously reveal something and conceal something else. In this double sense the screen becomes a practical achievement, an arrangement that articulates an open-ended method for aligning people and things. For me this suggests that we stretch the study of screens beyond the study of surfaces; that is, around, through, and away from the display. It also implies that screens in practice, or screening practices, can help us to articulate responses to the forces of calculation and coordination that order people and things. That is the task of this study of screens: to write for people who might articulate meandering trails, in order to grasp screens that might become the companions of wanderers and wayfarers. By folding screens for people and things as they trail along, I attempt to move sideways to disclose passages for practices of calculation and coordination that divert from centralized power. Before arguing that this disclosure relies upon the study of screens through becoming with them, by juggling with screens or attending to the timing/spacing of their alignments, in the next chapter I detail how screens might be understood to depend on centres of calculation and coordination to work in

everyday life. I explore this case with a device for “augmented reality” called Google Glass, arguing that all the alignments of screens that are bound to centres of calculation and coordination do not reduce, but rather shift, the blind spot of the observer.

## **Chapter 3.** The blind spot of Glass

Google Glass is a wearable computing device for “augmented reality,” with an optical head mounted display (laminated with a layer of liquid crystal on top of silicon). Shaped as a pair of glasses, the device may be instructed verbally to read e-mails, check the time, send messages, take notes – like a “smart” phone, but with a transparent screen worn on the face. Glass was designed by Google X: a research and development facility that experiments with prototypes potentially to be marketed by the tech-company Google. Before releasing a test version of Glass in 2013, Google shot a marketing video titled “One Day”, featuring the story of a day told from the point of view of a person wearing Glass.<sup>22</sup> From the video we get an impression of the social life of Glass, as imagined by Google. For example, in “One Day” the person wearing Glass never removes them from his face: he is always looking at people and things through this pair of glasses. In this chapter, I discuss this vision and its reduction of what screens are to a single surface. Glass is still under development today but the “explorers”, those selected by Google to test Glass, and those who are hoping to buy the commercial version, may not get a day with Glass as depicted in the promotional video. The impetus has flagged in response to several practical issues; from Glass perhaps looking too daft when worn in public, to privacy matters both for those using Glass and those around them. My particular concern regarding Glass, however, is with the project’s way of looking at screens in a way that reduces them to their display surfaces. What might be missed by paying attention merely to the display is what lies around and away from the screen. As I explain below, I learned this lesson from a dog named Emma.

Screens often take part in mundane practices by framing a single, frontal surface: a display that is made visible and becomes different from the other surfaces aligned in screening practices. Graphical figures can be displayed through a frontal surface – they can be enacted ‘on screen’.

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<sup>22</sup> <http://www.youtube.com/watch?v=9c6W4CCU9M4> (last accessed 24/08/15)

When designed as a see-through surface, like da Vinci's perspectival window (Friedberg, 2006:29), screens may also render transparent all of the various layers where graphical figures appear. What kinds of observers are implied then by screens, when seen as display surfaces? I unravel this question by reading the screen of Glass as a microdisplay that screens an observer's field of view. Google Glass may be seen as part of a collection of similar "smartglasses", including Microsoft's HoloLens or Facebook's Oculus Rift, which mount a transparent optical surface in front of a user. The alignment screens a graphical display on top of the surfaces of someone's field of vision. In practice this reduces screens to a single frontal surface that people cannot look away from. Let's grapple then with how screens can be singled out as graphical displays, beginning with the promotional video "One Day" where the screen, imagined by Google, (dis)appears from the point of view of its implied observer. A particular genre of storytelling, this video promotes Glass through the desire to inhabit the social life enabled by the device. Since Glass appears in such a cinematographic way, I read it through this way of unravelling time that, according to Henry Bergson (1911), is editable and cuttable in moments of movements that can be predetermined or estimated in advance. Then I compare "One Day" with another version, a satire in which all actions with Glass appear to break down.

### **Glass' empty gaze**

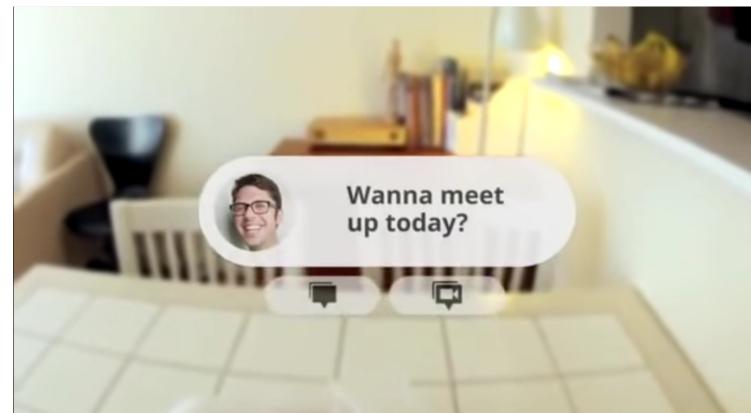
The plot of "One Day" starts on a couch. We hear music and see the white legs and flip flops of an implied observer. We never get to face the user of Glass during this video, because we see his actions from his point of view. This is an imagined portrait of Glass seen from the first person perspective, presented *as if* we were seeing through the screen. Rendering a day from this viewpoint, we are invited to see how it feels to use Glass. We note, for example, how the user's menu pops into sight over the field of view. Mounted on the user's face, Glass stays aligned with his

perspective on his surroundings. Walking as the user to the kitchen, we see Glass remind the user, while making coffee, to see his partner tonight. The message pops up as he faces away from the action of pouring coffee. Later the weather applet appears, automatically, while looking through a window, while the surrounding buildings outside, behind the graphical display, seem blurred out (figure 9). The story continues as movements around the house, as the user takes a seat to eat and to plan a rendezvous with a friend at the bookstore. At the table both actions fall neatly into place within the user's field of view. They become subtly overlapped through a focal point on the horizon, a mode of vision that the user embodies with a kind of empty gaze, which momentarily excludes from action what is immediately around him (figure 10).

**Figure 9.** Blurred background  
(image taken from "One Day")



**Figure 10.** Overlapped actions  
(image taken from "One Day")



I highlighted the moments where the background of the actions shown are blurred out because they signal the gestures of looking through Glass. When using Glass the screen, mounted on a pair of glasses, is placed in an upper corner of the wearer's lines of vision. But the gaze of that person, seen through the screen of Glass from the position of someone facing him, may feel like being looked at with an "empty" gaze – the gaze of someone staring behind you. I think that this effect signals how someone wearing Glass may lose touch of people and things around them. We

can also note how during the video everything seems automatically configured for the user. Glass pops up just in time when the user is near the underground station, alerting him that the service is suspended. A Google Map diagram kicks in, precisely overlapping images of the location of the user and the pathway to the bookstore, positioning him on top of the map and the city. This is an autonomous, transparent display of graphics showing a mode of vision that allows the user to inhabit a cyclopean eye. Across the footpath, this monocular sight is informed by arrows showing the path and an indication of the distance to the shop. In this way the day goes by as the user meets his friend, and finally serenades his partner. Glass' depiction on screen appears to display always meaningful data coupled with flawless interactions.

It seems not too much of a stretch to imagine that, during this story, people might respond to Glass by putting it away. Of course capturing that gesture is not an attractive promotional tactic for Google. Instead, the user and the screen appear always aligned. In imaginaries like Google's, as Malte Ziewitz observes, "the relationship envisioned between screen and user is necessarily constant and independent of the specific circumstances under which they [both] are observed" (2011:208). Something is missing in this portrayal of Glass' alleged capacity to follow the movements of the wearer. What might be excluded from this demonstration is the never fully predictable situatedness of an action with Glass, and all of the possible broken alignments that can render visible the transparent surface of Glass' graphical display. In other words, the situatedness of interacting with Glass is effaced from the story, articulating the screen as both transparent and autonomous.

## Google map

For Erkki Huhtamo screens have “a tendency to become invisible; they mediate perceptions and interactions, effacing their own identities in the process” (2012:145). If screens bring something into view and leave something else out of sight, then some screens screen themselves as well. Note that if screens are defined as alignments of surfaces, the effect produced by partly effacing screens does not create screenless images (Friedberg 2006:240), but rather transparent surfaces. In the case of Glass, the self-effacing tendency of the screen can be disclosed. Screens in general may be cracked. Alignments can be interrupted. A breakdown suggests, following Haraway (1988:586), a time where one may avoid seeing screens with a cyclopean eye, or as a thing capable of a self-satiated god-like mode of vision.<sup>23</sup> In the case of Glass, the imagined cyclopean eye is empowered by centres of calculation and coordination, rendering and “augmenting” (i.e matching) people and things on screen along with a layer of data synced by Google.

The Google (goggle) map shown in the Glass promotional video is an example of how this device's capacities would depend on Google's databases acting as centres of calculation, and Google's location-based apps acting as centres of coordination. We have defined a centre of calculation, following Latour (1987), as an array of movement around a trajectory, that maximizes the exploitation of people and things, and centralizes the extracted value. Building centres of calculation is what Google's databases are all about. They “profile” their users through the latter's interactions with the databases, configuring users as commodities by offering data-services that in turn mobilize Google's circuits of extraction of user's information. Google exploits user profiles for profits. Google's business is based on selling the data of people using Google's services to other commercial parties. On the analysis of Christian Fuchs, people's unpaid labour of creating

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<sup>23</sup> “Vision in this technological feast becomes unregulated gluttony; all perspective gives way to infinitely mobile vision, which no longer seems just mythically about the god-trick of seeing everything from nowhere, but to have put the myth into ordinary practice” (Haraway 1988:581).

information is Google's mechanism of exploiting users for profits: Google in processes of economic surveillance collects a multitude of data about usage behaviour and users' interests. The Google prosumer commodity C' is sold to advertising clients (the process C' – M'): Google attains money (M') from advertising clients, who in return can use the data of the Google prosumer commodity they have purchased in order to present targeted advertisements to Google users. Google thereby increases its invested money M by a profit p:  $M' = M + p$ . p is partly reinvested and partly paid as dividend to Google stockowners (2012:44). Google's ads sales surpassed the \$15 billion dollars mark during the first three months of 2015 (BBC 2015).<sup>24</sup>

Google's services are tied to apps luring people to profile themselves, as in the case of Google maps, which we may grasp as a centre of coordination (Suchman 2011). Using Google maps with Glass can be seen as pinpointing yourself with a location sharing service, one that coordinates people and things distributed across space and time, by relying on canonical means such as timetables and routes to denote trajectories and distances. But to act as a centre of coordination, the location sharing service needs to become helpful in coordinating distributed practices. This requires "a stable site to which participants distributed in space can orient, and which at any given moment they know how to find. At the same time, to coordinate a system of widely distributed activities, [participants] within the site must somehow have access to the situation of others distant in space and time" (Suchman, 2011:24).<sup>25</sup> Semi stable sites for Google maps may be articulated by mounting Glass on top of its user's field of view, though as we will see this is a stability prone to breaking down. Access to the situation of distant others appears to be made in this case through people's self-disclosure of their own positions, as shown in the

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<sup>24</sup> For Fuchs the trouble with companies like Google lies not so much in the services provided but instead in the relations of production of the prosumer (2012:46).

<sup>25</sup> I modified from the quote the word personnel and wrote participants instead to stress how my example from the video shows Glass screening a Google map, helping to coordinate a situation that is critical in relation to space, rather than time, by displaying a message triggered by a participant, rather than by personnel from a centre of coordination, such as a dispatch centre or a control room; two sites referred to by Suchman to exemplify her notion (2011:24).

promotional video when Glass alerts the user that his friend has shared his location: “Paul is 402 ft away”.

If databases and applications are Google's key devices to profit from this confessional economy, a way to contest the marketing of “selves” that complements Glass' alleged mode of vision, is to move sideways from the figuration of users as humans “augmenting reality”, by refiguring the cyborg (Haraway 1991) as a mean to situate responses to the screen of Glass. Moreover, situating screens helps us to study them as alignments of the surfaces of people and things, by stressing the historical contingencies, practical fragilities, and situatedness of such alignments. The move fuses “the ideological dimensions of ‘facticity’ and ‘the organic’ into a cumberstone entity called ‘material-semiotic actor’” (Haraway 1988:595). Note in the previous chapter how lines helped us to consider various material-semiotic kinds of screens, such as computer screens, firescreens, sunscreens, etc. The heterogeneity and multiplicity of screens becomes evident when simultaneously thinking about them materially and semiotically. So, thinking with lines as material-semiotic actors turns screens – when defined as alignments of surfaces of people and things – into an active and meaning-generating part of what Haraway describes as an apparatus of bodily production, without assuming the effects of screens as immediate but rather as made in practice.<sup>26</sup> For Haraway, what would count then as objective knowledge of a screen must be placed within the historically contingent practicalities of its alignment.

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<sup>26</sup> See chapter 5.

## **Breaking Glass**

Alternative takes on “One Day” with Glass, like that uploaded on YouTube by “Happy Toast”, reimagine the user’s situation.<sup>27</sup> This satire of “One Day” begins again with a user waking up, as Glass jumps into action. Also rendered from a first person perspective, now all appears less well aligned. The title, “Project Dangerous Glasses”, suggests that the point of this parody is to critique Glass’ alleged potential to “augment reality”, to make people or things thicker by overlapping their vision with data. “Augmenting reality” or making it thicker seems prone here to render life more fragile. Actions with Glass appear unstable on screen, as they cannot be always nicely overlapped onto a single frontal surface. Overlapping actions tend to break down: they may become dangerously disrupted by one another. For instance, in “One Day” eating at the table falls out of sight when a message pops up. In the satire, in contrast, the tea and biscuit remain in sight during the call, which leads the user to burn his hand (figure 11). The transparency of Glass can be shattered. Likewise, driving with Glass appears dangerous because its layer of data can repeat or obscure things (figure 12). Glass appears here to overload and break down rather than augment reality.

While the Glass promotional video depicts a first person perspective in which no contingent event, no unexpected activity seems to disrupt the processing of Glass’ functions, this depiction may be contested by showing how Glass’ mode of vision creates blind spots, and more generally by disclosing the problem in taking screens at interface value (Turkle 1995:19-26), an ontological assumption that reduces the screen to what happens *on* the screen. As discussed in the previous chapter, a screening practice cannot be reduced to a single surface, because people and things placed around and away from the implied observer of that surface, as signalled by Glass’ breakdowns, mess with what the display surface brings into view and leaves out of sight. Actors

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<sup>27</sup> <http://www.youtube.com/watch?v=Ma8NbpCvSwo> (last seen on 25/08/15)

positioned around and away from Glass' user may interfere with her alignment of perspective.

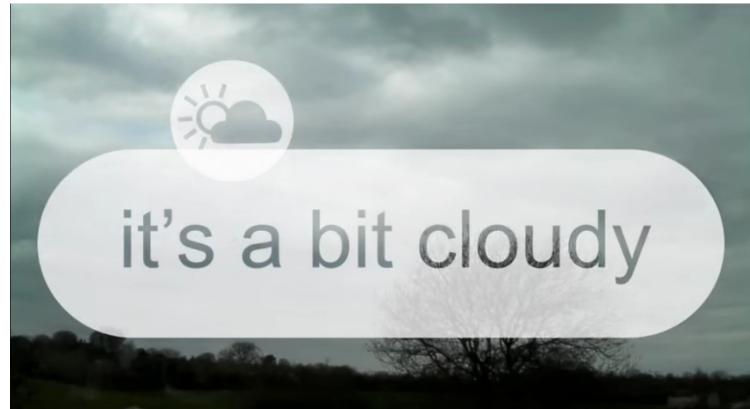
**Figure 11.** Shattering transparency

(image taken from “Dangerous Glasses”)



**Figure 12.** Overloading reality

(image taken from “Dangerous Glasses”)



The term blind spot underscores the limits of the observations of the user of Glass. Blind spots are non optional epistemic enactments, the excess “baggage” of located perspectives, the constitutive horizons of knowledge practices either modelled or situated in everyday life. Blind spots are what I relentlessly miss when looking at, touching on, paying attention to, having a gut feeling of or sensing in general my impression of being, or becoming alive. Blind spots bound the partial vision I relationally possess. What I can see you may be missing. Blind spots have been formalized as intrinsic to the observation of implied observers in cybernetics and system theory; used to think about society, as observing system, by Niklas Luhmann.<sup>28</sup> We may catch the blind spot of Glass by reading the promotional video from Google through the satire. Note how Glass responds exclusively to the commands of the user in the bookstore in the former. When he asks aloud about the music section, no one else pays attention or responds. All communications are informed, uttered, and comprehended by the machine with precision. In contrast, the flow of

<sup>28</sup> “Reality as such, the unity of the observing system and its environment, the paradoxical sameness of difference, of inside and outside, remains inaccessible; it is what “one does not perceive when one perceives it”, the “blind spot” that enables the system to observe but escapes observation. An outside observer can make this blind spot visible by distinguishing the observed system’s distinction as a form that contains both of its sides, but in doing so, any such second-order observation must rely on its own blind spot and is bound to reproduce the paradox of observation at the operational level of its own distinction” (Luhmann 1995:XXXIV).

significant interactions through the screen in the version uploaded by “Happy Toast” becomes interrupted by what is made to overlap with such a singular surface. Addressing Glass verbally is subject to the contingent responses and reactions from people and things around and away from the user. Note in the parody that the user in the bookstore needs to clarify, to a woman nearby, to whom his command is addressed; that is, “not you”. Conversely, what is on screen in the satire breaks down the practical flow of movement with Glass as imagined by Google. That is the case when, with a pinch of drama and comedy, the satire exaggerates how disruptions can occur by overloading the screen with information. So while the user inspects the sky, an oversized applet appears to block his view with useless data; a similar thing happens twice when he checks the time. While walking, driving, and shopping, Glass spams the view.

Wearing a technologically enhanced interfacing device like Glass all the time, without putting it away, means staying within the blind spot that Glass’s surface creates. The implied observer, seeing always and only through the interface, misses something around and away from Glass’s perspective. Sticking to Glass means refusing to shuffle around your blind spot: to “deaugment yourself” by putting Glass away in order to gain the different blind spot of a Glassless perspective. Regardless of how centres of calculation and coordination may be imagined to empower Glass, seeing always through the screen makes it tougher to grasp what lies around and away from it. Note how actions on and off the graphical display break down in the satire, as people or things situated around, through, and away from the screen are missed. What may be aligned on and off the graphical display – defined by what is brought into view through the screen – becomes dynamically interfered with by what is left out of sight – defined by what lies around and away from the user, who cannot help but always see through the screen of Glass. In this way, to handle the screen may be easier if the implied observer pays attention to what is iteratively brought into view and left out of sight – around, through, and away from Glass. It appears easier to attend to

what is on or off the display when people can juggle with their glasses, when they can put them aside to see around the screen when needed.

## Shakes

Considering screens without reducing them to user-centred interfaces seems helpful to rearticulate situations where people become figured as the implied observer, or the user of the screen. Aligning users frequently entails designing interfaces imagined to configure the flow of communications between humans and machines without blind spots. This tends to frame the screen as a component of interfaces configured to work flawlessly, through their predictive features. Screens become single frontal surfaces, graphical displays aligned in always timely ways with coded gestures triggering appropriate actions. But one can move sideways from these displays, interfaces, and stories of worlds fully rendered through the screen – by noting and dealing juggling or dealing with the breakdowns that suggest how situations around, through, and away from graphical displays mess with screening practices.

Glass' graphical display implies a dynamic and seamless alignment of people and things, while Google's video seems to insist on staging Glass encounters as effortless. On the other hand, the satire exaggerates how disruptions might break down Glass' screening practices. In both versions, “the user” and “the screen” remain paired. In one story the traffic of data provided by Google makes everything thicker and “augmented reality” is stabilised through the screen. In the satire the traffic of data makes everything not only thicker, but also fragile. Nothing seems stable when viewed through the screen. In both cases, users either excel or fail at using Glass. In both cases the duration of the videos are edited in advance. They are cut to promote or to parody Glass, since cinematography is a practice that makes it possible to divide the duration of movements into

predefined moments (Bergson 1911:332). The authors of the videos render visible through this technique attempts at marketing or mocking, by displaying alignments “like that of the pieces of glass that compose a kaleidoscopic picture. Our activity goes from an arrangement to a rearrangement, each time no doubt giving the kaleidoscope a new shake, but not interesting itself in the shake, and seeing only the new picture” (Bergson 1911:333). In this sense it appears that the shakes of seeing through Glass are alternately effaced or exaggerated in the videos.

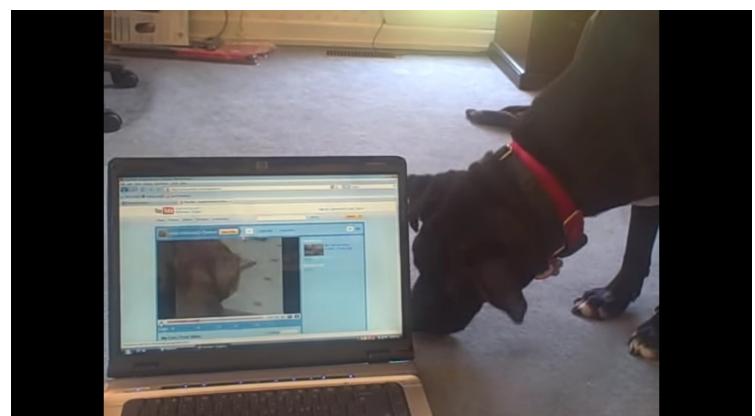
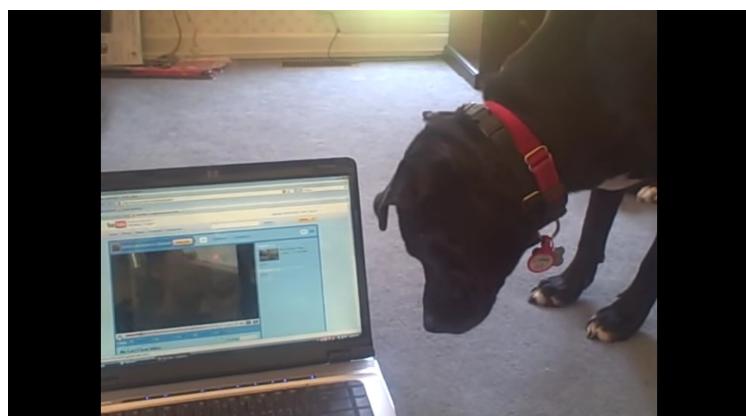
**Figure 13.** Seeing through

(image taken from “Confused Dog”)

(shake!)

**Figure 14.** Looking at

(image taken from “Confused Dog”)



I explore in the next chapter how people and things can juggle with each other by becoming with screens, but I conclude this one by introducing Emma, a dog who taught me how to look at screens by paying attention around, through, and away from their alignments. The video that captured her attraction to screens has been watched online by over a million “You-Tubers”:<sup>29</sup> this domestic video features Emma as a “Confused Dog” trying to come to grips with the graphical interface of a laptop displaying the video of a cat. Looking at the screen sideways Emma seems to turn her head sideways to see through the graphical display (figure 13); and again, in the next moment, she shakes her head to smell the backside (figure 14). I read her shaky response to this

<sup>29</sup> [http://www.youtube.com/watch?v=mFq\\_eMv6x2g](http://www.youtube.com/watch?v=mFq_eMv6x2g) (last accessed 05/09/15)

graphical display as an invitation to think about screens beyond user-centred configurations by moving sideways from with the display, to humans and dogs becoming with screens in animal-computer interactions.

## **Chapter 4.** Screening with dogs

As suggested with Emma in the last chapter, sniffing and looking behind the display, as one moment of encountering screens, made us curious about what is located around and away from them. With the help of more dogs, I consider in this chapter how to approach screens by “becoming with” them,<sup>30</sup> in the moments of movement around, through, and away from their display surfaces. In this sense, I attempt to delineate an ethnographic way to account for the agencies of screens. Rather than diving into or through their displays, I devise a way of approaching screens aimed at grasping their configurations.

For this task, I detail how a touchy and feely kind of ethnography (Crang 2003), when informed by insights from Animal Geographies, suggests a fruitful way to assemble approaches (or methods) with which to sense screens. The suggestion can be specified by asking who may become with the screen, and so may take a place around, through, and away from its display surface. Put another way, this is an approach to screens that seeks to account for them by sensing how the timing and spacing of their divisions makes and re-locates places for positioning people and things.<sup>31</sup> I consider in this chapter how conversations from the field of Animal Geographies help to understand how the articulations of screens create places (or not) for non/humans.

I locate this analysis within studies of the becomings of people and things. More specifically,

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<sup>30</sup> I borrow the openness of this question from Haraway's take on agility sport with her dog Cayenne: “[We] both know the difference when we have tasted the open. We both know the tear in the fabric of our joined becoming when we rip apart into merely functional time and separate movement after the joy of inventive isopraxis. The taste of ‘becoming with’ in play lures its apprentice stoics of both species back into the open of a vivid sensory present. That’s why we do it. That’s the answer to my question, Who are you, and so who are we?” (2008:242). In this chapter I argue that one may find a taste of the open while playing and ‘becoming with’ in less agile but still reciprocally inductive biodetection practices at MDD, what Haraway calls isopraxis when it comes close to a poiesis of love.

<sup>31</sup> This premise is explored further in chapters 6 and 7.

I suggest how biodetection or assistance dogs, human trainers, and machine prototypes may become with screens in two situations: a human-dog collaboration to screen cancer and an alarm system with a screen made up of animal-computer interactions. Through these cases I describe how the placement of screens for training divides a patchwork of moments of movement that enable both humans and dogs to cooperate with things like laptops and phones, by working and playing together.

I delineate how screens allocate such webs of human, dog, and machine relations by grasping their collaborations in biodetection practices, as training in the contact zone (Haraway 2008), and their cooperation in practices of care as texturing and enfolding architextures (Law and Lien 2013) of moments of movement. With this reading, I suggest that screens can be effectively reconfigured in less anthropocentric ways, to be more attuned to the functional requirements and lively needs of non/human animals. In the process, as discussed throughout this chapter, screens can articulate the creativities and affects of the animal.

### **Meeting dogs with important jobs**

Clara gets into her small city car and moves across the front seats, stretching her arms towards the passenger door to open it for me. It is early in the morning of a grey day in Milton Keynes, UK. During the last few months, I have been scheduling a visit to the Computing Department of the Open University. Dr. Clara Mancini, a research fellow trained in knowledge media, discourse theory and technology, has invited me here as a PhD student, coming from Lancaster University, to see the work-in-progress that she and her colleagues and students are crafting at the Animal-Computer Interaction Lab. It has been great to learn more about this interdisciplinary field, based in computer science. As Clara sees it, studies in Animal-Computer

Interaction (ACI) aim to reconfigure in practice the epistemological, ontological, and ethical grounds of interface design.<sup>32</sup> This has been a promising technoscientific adventure for me, a primordial fieldwork soup from which to address the question of for whom new materials for computer interaction are being developed. I'm struck by the extent to which in the development of graphical interfaces, from augmented reality to flexible screens, the prototypes are exclusively made to work for those figured as humans. To take note of how alternatives might stretch the designs of Human-Computer Interaction (HCI) to nonhuman users, Clara is now driving me past the parking lots of the Open University to visit a charity called Medical Detection Dogs.

Milton Keynes was planned as an architectural experiment more than fifty years ago. Perhaps more a large town rather than a city, one of its salient features are its roundabouts. Clara is driving us around several of these carousels for cars, while telling me more about Medical Detection Dogs (MDD) – a registered charity working with researchers, NHS Trusts, and Universities.<sup>33</sup> MDD's aim is to train specialist dogs to detect the odour of human disease. Collaborations between the Animal-Computer Interaction Lab and MDD revolve around the designing of technology to assist the dogs in tasks such as cancer screening. In recent years, research has been conducted by universities and charities like MDD, to explore dogs' biochemical capacities to scent and detect diseases such as cancer, by sniffing samples of urine and other fluids.<sup>34</sup>

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<sup>32</sup> I sum up with this phrase the many times that Clara and I talked about ACI during my visit to the Open University.

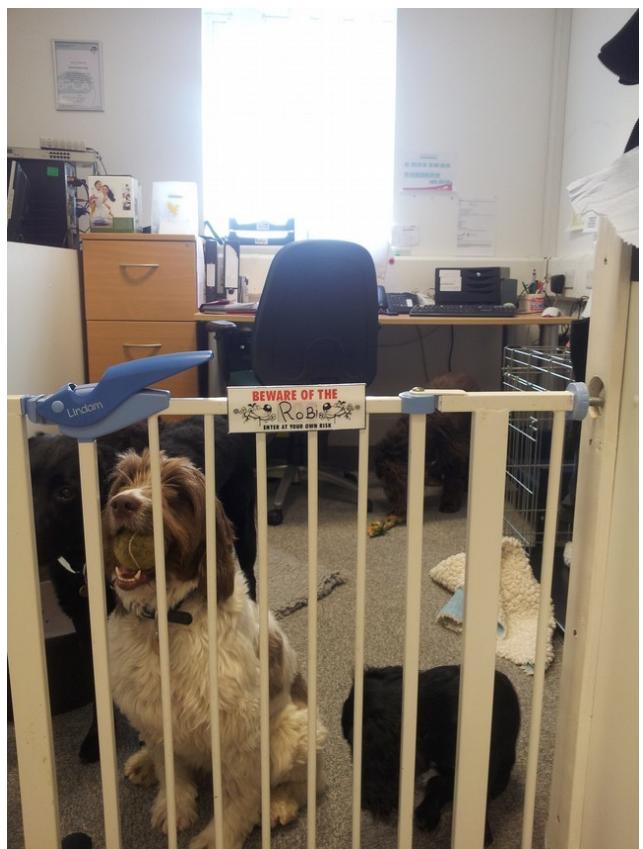
<sup>33</sup> [http://medicaldetectiondogs.org.uk/about\\_us.html](http://medicaldetectiondogs.org.uk/about_us.html) (last accessed 22/06/2016)

<sup>34</sup> Studies show how diseased bodies release volatiles with specific odours which a dog can smell. In the case of bladder cancer, “dogs can be trained to distinguish patients with [the disease] on the basis of urine odour more successfully than would be expected by chance alone. This suggests that tumour related volatile compounds are present in urine, imparting a characteristic odour signature distinct from those associated with secondary effects of the tumour” (Willis et al. 2004:1).

**Figure 15.** Medical Detection Dogs  
(photograph by author)



**Figure 16.** Play at the workplace  
(photograph by author)



In MDD dogs are trained for this task over a period of months, and both assistance and biodetection dogs come to work on a daily basis. On our arrival at MDD we are warmly welcomed by both the staff and the dogs. I'm happy to meet these dogs with important jobs, to see them on the chairs (figure 15) or playfully suggesting a break from work (figure 16). While greeting them, I take note of the placement of barriers acting as screens to bound these dogs, via division of the spaces meant for play from the places and the moments meant for work. Helping us to align or articulate a first encounter, these screens become part of our greeting ritual: a cross-species salute making meaningful and interesting who we might be for each other, a respectful gesture shaped by reciprocal curiosity for one another, where the question is who are you and so who are we? According to Haraway a greeting ritual is choreographic. It rearranges the “pace and elements

within the repertoire that the partners already share or can cobble together” (2008:26). It is an exchange of the partners’ ontological portfolios, so to speak, a creative disclosure, a dance informing through embodied communication what takes place and who becomes a partner in semiotic trade, and how such partners are fleshed or somatically distinguished as companions, patterned by movements making moments, places, people, and things present (or not) to one another.

Greeting rituals are open-ended ways of encountering partners as Haraway’s companion species.<sup>35</sup> Haraway explains: “I find that notion [companion species], which is less a category than a pointer to an ongoing “becoming with”, to be a much richer web to inhabit than any of the posthumanisms on display” (Haraway 2008:16). Her use of this term for animals is given by the meanings of the words species and companion; the latter pointing to a sense of keeping company or consorting while being “with bread” as messmates at table, thus signalling that anybody can be on the menu; the former addressing a respectful positioning that invites us to hold in regard, to notice or to look back reciprocally, by paying attention and so esteeming what can begin with such polite greetings, initiating a “becoming with” that eventually constitutes the *polis* where and when species meet (2008:16-19).

The sort of partnership addressed by the trope of companion species is key for the kind of work developed at MDD. Thinking with and activating the possibilities of people and things as companion species invites us to acknowledge that partners do not precede their meetings. Partnerships grow from mortal encounters with no pre-given answers and no innocent solutions (i.e. no lack of cost) for deciding what we are to become together. Polite greetings trigger reciprocal

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<sup>35</sup> In this chapter I use companion species to write about dogs and humans. But in later chapters, I use the expression “people and things” to designate the partners webbed or assembled into apparatuses like the self checkout of supermarkets (chapter 6) and the automated teller of banks (chapter 7). Nonhuman or human, living or not, partners emerge and sustain one another: bodies, accessories, organisms, tools, etc. are all matters of becoming with.

inductions in which partners struggle to recognize cues to each other's authorities (Haraway 2008:220). As discussed below, this reciprocity comes from responses that require training to situate the timing and spacing of conjoined activities and allocate the places and moments for work and for play. By way of the attention and respect required in order to respond carefully to one another's presence, partners become parties available to each other: they "become with and through" one another. Following Haraway's reading of Vinciane Despret (2004), partners are reciprocally attuned parties becoming more interesting in relation with each other, "more open to surprises, smarter, more "polite", more inventive" (2008:20) This kind of domestication is a training in cooperation.

Rob Harris, an experienced trainer of biodetection dogs at MDD, is talking now about the collaborations that emerge from such coshaping of humans and dogs as partners. After inviting Clara and me to attend a demonstration of cancer sample screenings by two biodetection dogs, Daisy and Lucy, Rob tells us about the precision of detail required for arranging the carousel designed for the task (figure 17). Wearing gloves, he shows us how to manipulate the samples previously acquired for medical research purposes (figure 18). The lab's working model explains how diseases like cancer and diabetes create biomarkers (e.g. altered blood sugar, volatile organic compounds) that enter the bloodstream and then exit through exhalation and excretion. These biomarkers are sampled for dogs to scent, performing a screening activity to detect cancer or diabetes in a sample (figure 19). Thus by taking samples of people when they exhale or urinate, Daisy and Lucy may sniff and then screen the biomarkers of specific diseases in bodies already diagnosed.

Sample screening by biodetection dogs is still experimental, which means that it is still under study for its value in medical practice. Researchers such as Taverna et al. (2014) have reported that dogs scenting volatile organic compounds of prostate cancer in urine samples can

achieve over 98 percent of success in screening sensitivity and specificity. For me that is quite precise.

**Figure 17.** Cancer screening carousel  
(photograph by author)



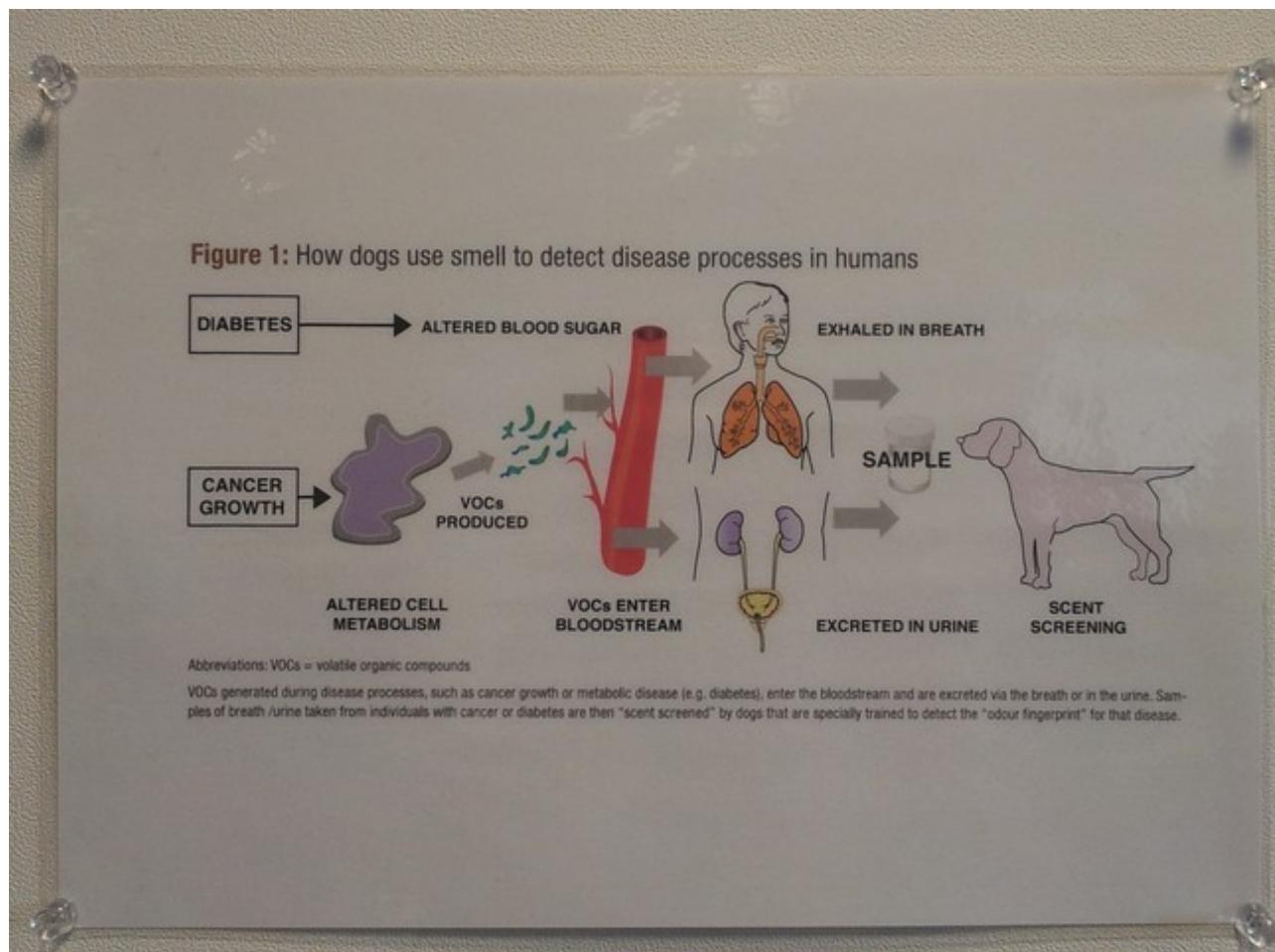
**Figure 18.** Samples with/out cancer  
(photograph by author)



In this shared workplace, samples that come from bodies with or without a disease are arranged around the carousel. The dogs in the company of human trainers and volunteers collaborate for twenty minutes, by iteratively moving around the carousel with the samples. This articulates different locations or points for the dogs to screen those samples with a disease by sniffing them. For a biodetection dog to acknowledge this workplace as a serious playground, training collaboratively means learning to focus on the specific markers of diseases. Dogs are rewarded when they pay attention to the markers – some dogs prefer a treat, some others like playing with a ball. Sounds good, but there is a catch. A dog can learn to read a trainer's body, instead of focusing on the biomarkers, to get the desired reward. As dogs read humans in very nuanced ways, for the trainer it is all about learning to help the dog to stay focused on the biomarkers. Both dogs and humans have to stay – in this reciprocally inductive way – with the

trouble of reading each other, by facing one another within the apparatus assembled around, through, and away from this carousel. Let's unpack this by looking in detail at those screens attached to the device, in order to grasp them through the movements of the dogs around the carousel.

**Figure 19.** Work model  
(photograph by author)



### Biodetection dogs screening cancer

The carousel is a roundabout of samples attached to metal plates serving as stations or positions for biodetection dogs to perform a course of action. The task starts with a release

command from the human partner, triggering a circuit of the dog around the carousel. Here biodetection dogs are trained to approach and sniff the samples in order to screen those with diseases. This walk around the plates of the carousel may be trained, more specifically, by arranging the stations on a straight line, to focus on the distances and the positionings in between dogs, humans, and samples. So a course of action with the samples arranged in a carousel, or in a straight line, may end with a reciprocal reward for both dogs and humans, who respectively obtain a desirable treat and valuable information. In the case of successfully or unambiguously screening the samples, an honest semiotic trade takes place, expressing joyfully in collaborative practice and embodied communication the result of hard training.

Lydia is one of the many volunteers I had the pleasure to encounter at MDD while witnessing the performances of biodetection dogs screening cancer. Lydia is handling a few samples prepared by Rob, attaching each to a metal plate coupled to a stand (figure 20) and positioning them carefully on a straight line (figure 21). In this way, the samples become the “targets” to be sniffed by the dogs in the event of a meaningful walk around the place. The arrangement continues in another corner of the room, where Rob places a bowl with water surrounded by a small fence. He asks Lydia to bring Daisy in, she makes her wait inside the confinement. Meanwhile, Clara is adding a pressure sensor to the plate of one of the stands, to collect data about the interest that biodetection dogs may express when scenting a sample; for similar purposes, the carousel is equipped with cameras registering the moments when the dogs sniff the samples. The precision needed to assemble the apparatus for the task requires subtle attention to the movements through which parties make things available to one another.

**Figure 20.** Plates and samples  
(photograph by author)



**Figure 21.** Stands on a straight line  
(photograph by author)



This kind of regard is exhibited in the moments and places around, through, and away from an alignment of samples. I prepare to zoom my own biomechanical eye into these moments of movement, now that Daisy is out of the confinement ready to walk around the aligned samples. She waits standing still for the release signal, looking at Lydia attentively.

I note the sort of mutual response that is expected to take place here is not a functional reaction, not merely triggered by the release signal, but devised through a cascade of joyfull anticipation (figure 22), because the task at hand includes the possible coming into being of unexpected things, novel and loose from the grip of functional calculation, as training is for “opening up what is not known to be possible, but might be, for all the intra-acting partners” (Haraway 2008:223).<sup>36</sup> The coshapings activated by training in cooperation make methods and

<sup>36</sup> As discussed in chapter 5, Haraway's use of “intra-action” follows Barad's agential realism; partners in intra-action do not precede their meetings.

create disciplines. But these outcomes will not exhaust the collaborative inventiveness of “becoming with”. Lydia and Daisy know what may happen next, but the moments and places around, through, and away from the aligned samples may open up a time and space too for something new and free. In this sense, Lydia and Daisy are about to work by threading and becoming the threads of a contact zone “where the action is, where the interactions change interactions to follow. [As here] probabilities alter; topologies morph; [and] development is canalized by the fruits of reciprocal induction” (Haraway 2008:219). *Sisi!* That is the sound to release her.

**Figure 22.** Release  
(photograph by author)



Daisy turns around promptly to make a pass by the first stand, misses it and goes to the second stand (figure 23); she scents the rest of the samples and turns around again, looking lost. Dogs like Daisy can only become lab partners, dogs with important technoscientific jobs, enrolled in practices of screening by scenting samples, if humans like Lydia can recognize the problem of

training as that of responding in the contact zone to each other's authorities. So when what becomes authored by a partner is missed, a breakdown of a course of action takes place. In this case, Daisy fails to recognize Lydia's authority as exerted around and through the apparatus, as evidenced by missing a sample. Lydia talks about the matter with Rob, they agree that the problem lies in the distance between the first stand and the next one. Re-aligning the stands, Lydia moves the samples a bit closer. Signs of departure such as release sounds are intrinsic to the immanences webbed in a contact zone. While beginnings and ends may appear arbitrary, to become partners means that no one can jump over the multiple entry points and exit passages created over a course of action. Thus, becoming in touch is always remaining in contact, by detaching each other from one course of action and (re)attaching one another to the next. Contact zones are then better understood as webs of interdependence with open-ended edges (Haraway 2008:218).

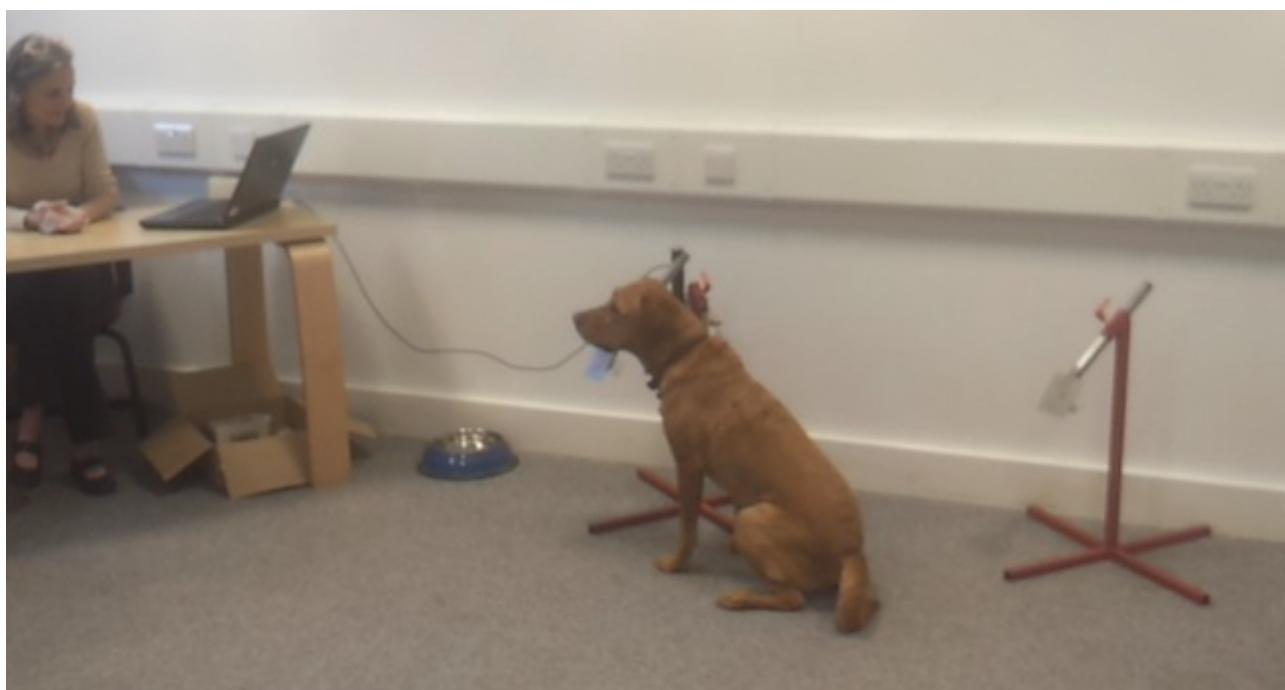
**Figure 23.** Sniffing  
(Photograph by author)



With the set of samples realigned, a new circuit around them can take place. After the

release sound, dog and human break face-to-face contact and (by going to the samples) Daisy creates an entry point: a fleeting mark of the beginning of this circuit around the stands, a passage through the apparatus. Then approaching the plate of the first stand, she sniffs and slows down, keeping her nose near the sample. She stops, turns around, and faces Lydia (figure 24). She licks, sits, and waits pointing diligently; for a moment her eyes hover in between Lydia and the stand. Then another mark, a clicker pressed by Lydia, making a poignant sound to signal the screening of a positive sample. Lydia and Daisy engage here in a semiotic trade creating data about the sample via embodied communication.<sup>37</sup> In this way, markers like a clicker triggered by a human partner can affirm a biodetection dog's response while the latter is still facing the sample. This wraps up the circuit, opening up exit passages for different outcomes crafted during the task at hand: including the data about the samples, the affects after a job, and the volatile compounds of a cancer.

**Figure 24.** Screening  
(photograph by author)



<sup>37</sup> Biodetection dogs like Daisy are rewarded in all cases where the samples are correctly screened, including the positive detection of negative samples only. The acknowledgement of non-literal gestures (metacommunication) is key here.

When a smooth circuit with an unambiguous screening of the samples takes place, play dovetails into this workplace. The grace of play may be already felt and performed during an excellent walk around the samples, but in the exit passage the circuit includes a moment of movement for the joy of “getting it” in this contact zone. When work and play are fused by acknowledging and acting out the workplace as a serious playground, dogs stretch the joy of successful walks by getting a reward and playing some more, a contagious affect that reaches human partners as well. The growth of loving bonds via reciprocal induction matters in this workplace (figure 25). Lydia is bringing Lucy in now, and she says that Lucy gets stressed easily, and prefers to train with Lydia as she can read her particular body language, and vice-versa. It is difficult to explain why, says Lydia. But perhaps it is because “unexpected conjunctions and coordinations of creatively moving partners in play take hold of both and [project] them into an open that feels something like an eternal present or suspension of time, a high of “getting it” together in action, or what I am calling joy. No liver cookie can compete with that! (Haraway 2008:241).

Exit passages of well-webbed contact zones throw both trainer and trainee back into “the open” by enfolding unexpected effects into the moments of movement of a circuit. We can see this more clearly by paying attention to the screens of the alignment of samples. I have articulated four moments of movement: a time to release, sniff, screen, and reward. Note how play may be exhibited in the anticipation of the release, and in the joy of a meaningful circuit. Since play happens not only during the moments of reward, when collaboration breaks down, play is also ripped apart. In other words, while the fences of our greeting ritual separated work and play, the metal plates of the carousel and the aligned samples dovetail or diffract work and play together apart.

**Figure 25.** Lydia and Lucy

(photograph by author)



Screens here conjoin the work and play of both partners in motion, and separate those movements into different moments around, through, and away from the samples. Most helpfully, markers such as the release signal, the organic volatiles, and the clicker draw attention to the position and division of dogs, humans, and samples aligned by screens here in biodetection practices. I build on the point developed in earlier chapters, that there is a practical difference between a screen and a surface. To study screens, one has to include the gaps between the surfaces, to account for screens or screening practices as placing divisions, resulting from the alignment of surfaces and the gaps between them in particular situations. So, this way of accounting for screen agencies includes what they may configure through their surfaces, and also how they affect what happens around and away from them. By looking beyond the visual display of the surfaces of screens, I pay attention as well to their capacities for placing divisions. I think this helps to grasp in practice how screens configure functions that overflow what happens in the framing of their surfaces or “interfaces”. In this sense, the screening of samples in the lab may not be reduced to the

moments when these dogs sniff the metal plates, as this biodetection task depends on a circuit, performed by both humans and dogs, that stretches around and away from the aligned samples.

In the contact zones created at MDD for biodetection dogs to screen cancer, the interdependencies of the task that thread dogs, humans, and samples together intersect with the people and the things that articulate the moments of movement needed for releasing, sniffing, and rewarding the humans and the dogs. In this sense, the moment of release presupposes that people and things at MDD have already made a space in which to place the carousel or the line of samples. The moment of release signals how all the surfaces around the stands at MDD – the desks, papers, chairs, mugs, walls, ceilings, floors, etc. – are all in position ready to bound a circuit around the samples. It also takes some hard work to align the stands: sniffing is about what follows the release, a moment of movement around the stands when biodetection dogs take (or don't) each sample into account, and stay in touch (or not) with their human partners, stretching a passage that acknowledges the placement of the dog's authority. I discussed above how the gaps in between the stands make a place for the entry points and exit passages of a circuit. Their alignment is needed for the screening of the samples. The carousel makes this evident by allocating a roundabout of gaps in between several metal plates, placing stations for dogs to screen the samples. We may also think about this by taking this place as a laboratory: a kind of experimental site upon which people may exert a matrix of coordinates. The metal plates can be taken as part of a medical research apparatus that affixes a set of ordered points and gaps to coordinate or circulate references in practice, as suggested by Latour (1999). In this way, dogs are not the only ones looping in the circuit around the aligned stands. In the presence of a positive sample, the dog and the cancer may circulate together, “with and through” each other, since this apparatus co-locates them through “what is called reference, both in geometry (through the attribution of coordinates) and in the management of stock (through the affixing of specific numbers)” (Latour 1999:32). Precision matters.

But sniffing accurately is not enough. What follows is the actual task of screening the samples, a moment of movement when the dogs respond to what they sniff through the plates. While training with biodetection dogs means iteratively aligning them with the samples, in the presence of cancer the dogs themselves become screens, by sensing, filtering, and bringing into view the disease for a human partner. But at the same time, this action begs the question of how exactly biodetection dogs detect the volatile compounds of the disease, as researchers do not know how these biomarkers become so meaningful for them.<sup>38</sup> On the one hand, this apparatus for medical research offers a chance for a human partner to witness a biodetection dog's authority while responding to the samples. On the other, to allow biodetection dogs to detect cancer while remaining silent about their methods may be controversial. One stark position in the debate is captured by the words of Brian Palmer, writing for the digital magazine Slate.com. "Perhaps we need a small core of well-trained animals to help us figure out what, exactly, the chemical signals are. Machines – man's other best friend – can take it from there."<sup>39</sup> Making such machines by borrowing from the work of training biodetection dogs is indeed an option opened up by reconfiguring the moments of screening the samples. We can think about this as an alternative located alongside other rewarding outcomes of a circuit. Thus training with biodetection dogs to screen cancer may result in engineering a valuable device that aims to automate the detection process. In this case the process would not implicate a human-dog, co-evolving friendship, but instead a human-machine interaction, both orientable towards the screening of a disease. So my only remark is to disagree with inviting biodetection dogs to collaborate in the lab only to be later disregarded as partners for less organically assembled technologies (such as robot noses to detect cancer). Let "man's other best friend" take it from here? I prefer to let humans, dogs, and

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<sup>38</sup> The challenge lies on finding exactly what it is the dogs can smell, because researchers cannot tell what markers they are sensing.

<sup>39</sup> 'Roll Over! Shake! Smell This Mole! Are dogs really a good way to screen for cancer?' By Brian Palmer. [http://www.slate.com/articles/health\\_and\\_science/medical\\_examiner/2014/05/cancer\\_sniffing\\_dogs\\_can\\_dogs\\_detect\\_and\\_screen\\_for\\_disease.html](http://www.slate.com/articles/health_and_science/medical_examiner/2014/05/cancer_sniffing_dogs_can_dogs_detect_and_screen_for_disease.html) (last accessed 15/06/2016)

machines collaborate. In this case, exemplified by my reading of the plot of biodetection practices at MDD as training together in the contact zone, partners unlearn assumptions about one another and enrich each other's ignorance, to borrow Haraway's words. Here I prefer to stay with the trouble of training with biodetection dogs, the values they attach to science and technology, and the affects they share with humans in the laboratory.

The exit passage is a moment of movement that provides an occasion to think about what is made in a course of action. While the creativities of dogs and humans are evident in their collaboration around the carousel and the line of samples, the derivatives of their inventive isopraxis expand beyond the moment of screening. One such creation is the pressure sensor that Clara attached to one of the stands in order to investigate the dogs' confidence in the moment of screening. In practice, sometimes a biodetection dog appears to signal more than just binary answers. So, when working well, a pressure sensor can help to discriminate the responses of biodetection dogs, as the collected data may show that sometimes these dogs utter something else beyond yes or no. Setting the pressure sensor for the task seems tricky: it should be robust enough to react to a dog's touch yet precise enough to sense the pressure applied. Yet "getting it" opens up human-dog exchanges in semiotic trade. "It is not potentially infinite expressiveness that is interesting for play partners," Haraway writes, "but, rather, unexpected and nonteleological inventions that can take mortal shape only within the finite and dissimilar naturalcultural repertoires of companion species" (Haraway 2008:237). To train and to play together in the contact zone, calculations, methods, disciplines, sciences, technologies, etc. are required at MDD for proposing how people and things may become with and through one another. Nevertheless, play is not tamed by the rules produced to work out those propositions because "play needs rules but is not rule-defined" (Haraway 2008:238). Thus while a pressure sensor feeds the calculations of Clara's laptop, this task momentarily entails a letting go of the literal, to open up the binary patterns of

communication embodied in semiotic trade (Haraway 2008:239). I will make this point once more with another example of screens in Animal-Computer Interaction, but first I turn to the wider question of the place of animals in science and technology.

### **Bringing the animals back in again**

In a special issue of Environment and Planning D on Animal Geography (1995), Jennifer Wolch and Jacque Emel note that much social theory remains stubbornly anthropocentric. When it comes to controversies about social or natural issues, they observe, the consistently invisible contribution and the suffering of non/human animals tends to be out of the debate. Human “natures and societies” are rarely called into theoretical or practical question, as figurations that silently assume differences between humans and animals. These distinctions are typically based on cognitive capacities of technological expression; in particular, whether tool making is regarded as infused with linguistic creativity or symbolic communication. In science and technology studies, the consequence of naturalizing this distinction in social history has been most notably examined by Latour and Haraway. They critically claim that 'we' have never been modern (Latour 1993) nor human (Haraway 2008) – meaning that people and things cannot be smoothly reduced to any Grand Divide of the Social and the Natural. Similarly, Wolch and Emel recall that animals are “central to environmental sustainability, economic and social order, personal relations and individual identity, and conceptions of justice and morality” (1995:632). Through this reminder, they bring the animals back in as non/humans knotted in mortal bonds, rather than as naturally other and detached.

While Wolch and Emel remind us not to take the Human and the Nonhuman as a Grand Divide, I stretch this insight further to study what might happen when animals are brought back in to our thinking about screens, without assuming in advance what humans and non/human animals

are. I consider the human and the animal as *becomings*, useful to think with when taken as made in figurative processes. Made through configurations, the human and the animal are not only symbolic but lived textures, fleshed out in practice.

Wolch and Emmel's invitation to bring the animals back in was followed by a series of further publications (Wolch & Emel 1995, Philo 1995, Philo & Wolch 1998, Whatmore & Thorne 1998, Philo & Wilbert 2000). This new impetus encouraged Geography to think about culture and nature at the border of Human Geography (Anderson 1995), a push that consequently made a place in theory for the study of animal geographies. The relevance in Geography of the mutual influence of non/human animals on each other (a traffic across the non/human distinction) was noted much earlier in Bennet's (1960) call for a cultural animal geography (Philo & Wilbert 2000:4). While older traces of the study of animals in physical Geography go back to Zoogeography at the turn of the nineteenth century, as defined by Philo & Wilbert, Animal Geography focuses on how "animals have been socially defined, used as food, labelled as pets or pests, as useful or not, classed as sentient, as fish, as insect, or as irrational 'others' which are evidently not human, by differing peoples in differing periods and worldly contexts" (2000:5).

Animal Geography is concerned in this way with the placement of animals and their configuration in nature and society, as well as with devising ways of thinking with and living as non/human animals. The senses of place that Animal Geography is eager to explore are the placement of animals in classificatory schemes – where the empire of "the proper" rules in the place: the elements taken into consideration are beside one another, each situated in its own 'proper' and distinct location" (de Certeau 1984:1774 see also Philo & Wilbert 2000:6). Animal Geography can be interested too in escaping these human orderings, curious about how animals open places for themselves, resisting the placement of non/human distinctions.<sup>40</sup> Here I highlight how studying

<sup>40</sup> The 'proper' places animals can escape from are conceptual and material, as well as temporal and spatial, in

screens with animals interpellates matters of placing the animal in technoscience.

In Animal Geography, Media and Cultural Studies, in Sociology and Anthropology, or in Science and Technology Studies, I find it hard to find examples of cases where animals in technoscientific contexts are *not* placed as symbolic representation, raw material or objects of research. There are significant matters to talk about when animals are placed in such ways in science and technology.<sup>41</sup> But the topic of collaboration between animals and machines, and more specifically the issue of inviting animals to work with scientific apparatuses, to perform as lab partners, is rare. Examples of human-animal collaborations may be found at the crossroads of animal studies and science and technology studies; take Haraway's 'becoming with' her dog Cayenne in agility sport for instance (2008:205-248). Nevertheless, cases of partnerships in configuring the animal, the human, and the machine in the midst of laboratory work are rare. Studying then the collaboration of machines such as screens and animals such as dogs is a contribution to the geographical examination of places where animals and machines can work together, rather than appear as backdrops for configuring the human. Interestingly, screen and animal agencies alike can be misleadingly taken as springing just from their surfaces. It is not just animals that may be seen as a surface for imagining the limits of the human (Philo & Wilbert 2000:5), but also screens may be reduced to the passive surfacing of a display for and of the human. This neglects the placement of the divisions between the animal, the human, and the machine as a creative achievement, a lived difference materially realized by more than human agencies.

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classificatory schemes and physical locations, from the wildernesses 'out there' to the cities 'in here'. While reviewing literature for this chapter, John Law and Annemarie Mol (2002:14) citing Michel Foucault (1970) happily reminded me that Jorge Luis Borges tells the story of an odd ordering scheme for animals, the Celestial Emporium of Benevolent Knowledge. This taxonomy sorts out animals into: (1) those that belong to the emperor, (2) embalmed ones, (3) those that are trained, (4) suckling pigs, (5) mermaids [or sirens], (6) fabulous ones, (7) stray dogs, (8) those that are included in this classification, (9) those that tremble as if they were mad, (10) innumerable ones, (11) those drawn with a very fine camel hair brush, (12) et cetera, (13) those that have just broken the flower vase, and (14) those that, at a distance, resemble flies.

<sup>41</sup> For example see Lansbury (1985) on vivisection; Birke (1994) on feminism, animals, and science; Ryan (2000) on animal photography; and Franklin (2007) on animal clonation.

The problem of how animals might be studied in (human) Geography for their place in sociocultural contexts, including technoscientific ones, is most clearly stated by Chris Philo. Whereas in human geographies animals become members of a society (at least in theory) by accounts of their utility to humans, in animal geographies they must be seen as “enmeshed in complex power relations with human communities, and in the process enduring geographies which are imposed upon them ‘from without’ but which they may also inadvertently influence ‘from within’” (Philo 1995:655). Note how Philo's sense of enduring a geography points to animal suffering. But this expression may be read as well in the sense of materializing concrete geographies imposed 'from without', while animals can offer a resistance 'from within' to this process. These powerful utterances of resistance are tied to practices of discipline and domestication. Still, within this narrative, alternative histories may be performed across the non/human distinction (Ingold 2000:61-76). As stated more recently by Henry Buller, the anthropocentric accent of theory, including Geography and studies of animals in science and technology, has given way to questions of legitimacy: “to ‘speak’ for, to and with animals or demand a radically different biopolitical or cosmopolitan engagement” (2014:310). For me, collaborations between non/human animals work well to investigate such matters. Carefully articulated meetings afford the possibilities (at least in theory) of avoiding domination. They subvert the stress of creating ways for non/human animals to escape any foul engagement. Creativity becomes redirected to craft response-able partnerships without “any ‘final peace’ of a uniform yet predetermined accord” (Buller 2014:315, paraphrasing Haraway 2008:297); and one example of such creative and inexhaustible making goes by the name of animal-computer interactions.

## Morphisms and ethnographic approaches in Geography

The anthropomorphization of non/human animals in Geography is a tricky and perhaps unavoidable matter. Yet making people and things anthropomorphic can be detached from considering the human as an anthropocentric essence: a fixed attribution of specific organisms always born human in advance. As mentioned above, anthropomorphization can rather signal a traffic across the non/human distinction. It may be one way, one tool to configure or to give particular forms: a morphogenesis to shape versions of the non/human. It is not an essentialist, representative move, but rather the making of a distinction – a boundary attributed to multiple people and things. Anthropomorphization is one technique to devise the non/human; one assemblage<sup>42</sup> to become non/humans. If anthropomorphization is a morphogenetic process, then rather than anthropomorphism “we should be talking of many different possible 'morphisms', whether these be technomorphism, zoomorphism or whatever. The claim is that the term 'anthropomorphism' actually 'underestimates our humanity'" (Philo & Wilbert 2000:19, paraphrasing Latour 1993:235, 1993:137). Latour's point is that the 'anthropos' and the 'morphos' together signal that which attributes human shapes, and that which gives shapes to humans.<sup>43</sup> Anthropomorphization is a fleshy becoming. But things can be otherwise and people can be refigured. The anthropomorphic is not necessarily an anthropocentric configuration, if one considers people and things as immersed in processes of becoming non/human and otherwise. Thinking with morphisms is useful then for putting into practice more inclusive (less anthropocentric) ways of becoming; for example, to configure collaboration as a “common cause

<sup>42</sup> See chapter 5. The concept of assemblage has a rhizomatic emergence in various disciplines. For a definition see Gilles Deleuze and Felix Guattari's *A Thousand Plateaus* (1987). For applications in philosophy or science and technology studies see Manuel DeLanda's *A New Philosophy of Society* (2006), Bruno Latour's *Reassembling the Social* (2005), and John Law's *After Method* (2004). For a take on Foucault's apparatus (*dispositif*, device) as an assemblage see Deleuze's *What is a Dispositif?* (2007:338-348).

<sup>43</sup> See also Haraway (1989) and Castañeda & Suchman (2014).

with animals in creating genuinely shared spaces able to sustain them simultaneously if differently” (Philo & Wilbert 2000:20).

Grasping how people and things morph or become distinct entities is a methodological challenge. I will examine this question by borrowing insights in support of ethnographic approaches in Geography. I situate the issue as a problem of grasping animals morphing or becoming distinct non/human entities, when placed “simultaneously if differently” in Animal-Computer Interaction. If Animal Geography “challenges not only the place and placing of the human and the animal but, critically, the methods we use to engage with both in relation” (Buller 2015:374), then ethnographic approaches to Geography seem crucial insofar they offer a reflection or consideration of the placements of the animal, the human, or the machine. As Buller observes, “methodologies have been the mechanism by which such ontological and epistemological divisions [between non/humans] have, in the past, been maintained” (Buller 2015:375).<sup>44</sup> At the same time, challenges for ethnographic approaches to animals in Geography are linked to the reminder that animals look back and express something that might be grasped, at least as an impression, by those who “take upon themselves the address that an animal addresses to them” (Derrida 2008:14).

Timothy Hodgetts and Jamie Lorimer's (2015) and Henry Buller's (2015) articles on methods in Animal Geography help me to trace how ethnographic approaches have encountered the gaze of animals. With them I sense that methods to meet non/human animals become a prosaic matter of training. Buller writes that methods such as ethnography in Animal Geography need to try to disentangle themselves from “the anthropocentric and humanist social sciences, with their Durkheimian emphasis on social facts, social institutions, collective intentionality and individual reflexivity, coupled with, after Mead [1964], the thrust of symbolic interactionism [since they] place language as a prerequisite basis for entry into the 'social'" (2015:375). Methods to elude the Grand

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<sup>44</sup> See also Taylor's “Animals, Mess and Method: Post-humanism, Sociology and Animal Studies” (2012) drawing on Law (2004).

Divide can instead shift the focus back and forth on non/human morphing: becoming animal, human, machine, etc. Buller suggests this is a triple challenge. Animal geographers have to train themselves in 'going beyond' or grasping the assemblage of ordering schemes (taxonomical rankings) by focusing on animals as entangled (enmeshed) with non/human distinctions in their specific becomings. This is the crossing of their *Umwelts*, as put by Jakob von Uexküll, a concept to signal the environment of animals, an ethological term that appears in the philosophical approaches to animals created by Heidegger, Mearleau-Ponty, and Deleuze (Buchanan 2009). Animal geographers have to practise with non-representational approaches for letting animals 'speak' while attending to the animal that sees (Buller 2015:376). And for this task, animal geographers have to keep exploring how to build response-able accounts of their touchy, feely, bodily impression of what matters to non/human animals.

Writing for ethnographic approaches in Geography and elsewhere, Stever Herbert (2000) insisted that ethnography gives irreplicable insights into the processes, meanings, maintenances, and motivations of group formations or collectives: "If sociality and spatiality are intertwined, and if the exploration of this connection is a goal of geography, then more ethnography is necessary" (Herbert 2000:564). Ethnography captures the situations, generalizations, and variations – i.e. the occurrence, redundancy, and change – of meaningful practices. It provides unique approaches to the daily placement of capacities and motives for the maintenance and variation of signifying processes. Then for Herbert, "these processes and meanings vary across space, and [they] are central to the construction and transformation of landscapes; they are both place-bound and place-making" (2000:550). He highlights how ethnographies may be tuned to grasp the placement of non/humans, by simultaneously acknowledging and responding to the various criticism made at the time to ethnography.<sup>45</sup> Likewise, Mike Crang (2003) critically reviews the limits of ethnography in

<sup>45</sup> "The aversion to ethnography may derive from three major criticisms frequently directed toward it: that it is unscientific; that it is too limited to enable generalization; and that it fails to consider its inherent representational practices. Considered responses to these critiques, however, restore ethnography's significance for geographic

Geography. He examines biographic, visual, performative, and haptic takes of daily life as a practical accomplishment.<sup>46</sup> In his view, the engagements of researchers with those met in ethnographies (signalled by a touchy-feely sense of proximity) have been, in fact, limited in touching and feeling.<sup>47</sup> I read Crang's invitation to push for the exploration of sensibilities in ethnographies as a suggestion to take seriously how research places make sense. I take the point as made also by Sarah Pink's sensory ethnographies: "I suggest thinking of analysis as a way of making ethnographic places. Analysis might not [be] always distinguished from other activities. It is indeed as sensorial a process as the research itself" (2009:3).

Mark Paterson (2009) has given an interesting assessment of haptic geographies in connection with ethnography, haptic knowledges and sensuous dispositions. His paper offers an "overview of the treatment of haptic knowledges in Geography, responding to [the] bodily sensations and responses that arise through the embodied researcher [after Crang's article on 'touchy-feely' methods]" (766). Noting the haptic as a conceptual move coming initially from psychology's interest on (synaesthetic) bodily sensations, as distinct from the classification of senses (e.g. the visual, the tactile, the olfactory, the gustatory and the auditory), he suggests a "return to the senses" within social research, most notably within anthropology, architecture, cultural history and sociology, [rethinking] the positioned processes of research through the senses" (Paterson 2009:767). Considering Hayden Lorimer's 'sensuous dispositions' (2005:84), Paterson reviews the shift from studying discourses of embodiment, to grasping new ways of feeling that would "arise through the technologies, disciplines and practices of late modernity" (2009:767).

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study" (Herbert 2000:550).

<sup>46</sup> This entails a long tradition of studies about daily life with ethnomethodologies. To name just a few tackled by Crang (2003): Smith 2001; Laurier 2001; Laurier et. al. 2001, 2002; Duneier 2001; Stoller 1997; Dewsbury & Naylor 2002.

<sup>47</sup> "The solid grounding of qualitative fieldwork in the engaged reality of people's lived experience seems coupled to a focus upon verbal methods that paradoxically means qualitative work tends to produce very wordy worlds. So, on the one hand there is a caution about visual methods, for fear of an objectifying realism, and, on the other, a focus upon discursive construction produces forms of knowledge that are densely textured, in every sense [...] I have suggested that the response to this need not only be more writerly texts, but also to push further into the felt, touched and embodied constitution of knowledge" (Crang 2003:501).

Ethnographic sensibilities seem helpful for methods in Geography and elsewhere to (re)build actors, i.e. to extend the associability of agency to any entity acting upon another or enrolling an actor. Actors are devised then as multiple: as associations, as networks, or as assemblages. They become actants in the vocabulary of actor-network theory, with its attention to non-human agencies (Latour 1983, Callon 1986). Actants would collect their associations symmetrically, since the conceptual move extends the associability of agency to entities in equal terms. What is tricky about this approach has been acknowledged (see Law and Hassard, 1999) and reworked by listing networks as one mode of association (Law and Mol 2001, Law and Singleton 2005, Law and Moser 2006).<sup>48</sup> Philo has stressed how in Animal Geography with actor-network theory (and after) it is “not foolish to be talking about animals possessing a measure of agency” (2000:17). Nevertheless, for Philo, what animal geographers should avoid is taking animals as ‘shadowy presences’: animating the concern of methods for their agencies while neglecting the question of becoming animal, of morphing into different species or entities.<sup>49</sup> When animals are fixed or taken just as nonhumans, they seem to “stay in the margins more than is the case for humans in, say, the qualitative and cultural turns of the discipline over recent decades” (Philo 2005:829).

Writing more recently for ethnography in Animal Geography, Buller vouches for different ethnographic approaches as observational and participatory devices that attend, “on the one hand, to the performance of routine practice and, on the other, to eventful and troubling interruptions” (2015:

<sup>48</sup> Latour has instead modalized the network, in a different way, as a mode of existence. “Networks [net] have a limitation: they do not qualify values. Law offers a point of comparison through its own particular mode of displacement. There is thus a definition of “boundary” that does not depend on the notions of domain or network. The mode of extension of objective knowledge can be compared with other types of passes. Thus any situation can be defined through a grasp of the [net] type plus a particular relation between continuities and discontinuities” (2013:vii-viii)

<sup>49</sup> Animals may not be the only non/human entities ‘shadowed’ while trying to account for the presence of their agencies. Attila Bruni (2005) for instance, studying software to manage clinical records, suggest less critically that “shadowing non-humans requires the ethnographer to be able to orient his/her observations to the material practices that perform relations, and probably also to devise new narrative forms able to make that performance accountable” (374).

4).<sup>50</sup> Similarly, Hodgetts and Lorimer have emphasized ethnographies that focus on “attitude, intent, and purposeful action’ in animals.” (2015:3). The suggestion is to thread ethnographies by outlining bodies, movement, being, and knowing together in practices with nonhumans: to account for knowledges that cannot be thoroughly attributed to human agencies (Barad 2003). The point is not to get stuck with one approach to agencies, but to keep unearthing animal practices – ethnographically or otherwise – by turning to further concepts: “to biophilosophy, notably what [Whatmore] calls Deleuze and Guattari’s ‘vital topology’ (2002:5), but also to feminist science studies (after Haraway), new phenomenologies of embodiment (inspired by Merleau-Ponty) and non-representational theories [following Thrift 2000, 2007]) of performance and communication” (Philo 2005:826, discussing Whatmore 2002).

I collect and use these conceptual resources conjunctively. Below I will put them into practice by articulating an ethnographic approach to non/human animals in the geographies of animal-computer interactions, in the placement of animals around, through, and away from technoscientific apparatuses, in collaborative practices with non/human animals and screening machines. I attune my ethnographic sensibility for the task by focusing on performances and communications (by following the attitudes, intents, and purposeful actions of non/humans); drawing (on non-representational theories of diffraction) in order to grasp a touchy, feely, bodily way of placing non/humans, thus of spacing and timing their interactions.<sup>51</sup> I think these resources are helpful to assemble a common practical and conceptual cause when studying animals and screens. They suggest a move away from taking animals and screens only as surfaces that configure boundaries of and for the human. Instead, they point to the agential becoming or surfacing of

<sup>50</sup> These ethno-methodologies assemble and devise multispecies (Kirksey & Helmreich 2010) and trans-species ethnographies. This passage by Buller (2014) enumerates just a few: “from Alger and Alger’s [1999] study of a cat shelter to the avowedly ‘non-experimental’ filmic investigation by Laurier et al. [2006] of dog walking in a Swedish park; from Despret’s [2005] ethno/ethology of scientific engagement with sheep in the field to Roe’s ‘experimental partnering’ in a field of cows [Roe and Greenhough 2014]; from Barua’s [2013] multi-sited ethnographic reanimation of elephant tales to Davie’s [2013] emergent cartographies of monstrous laboratory mice” (4).

<sup>51</sup> An approach that will be developed further in chapters 6 and 7.

screens and animals, as figurations assembled or materialized around, through, and away from apparatuses.<sup>52</sup>

### **Charlotte's canine alarm system**

Like human-computer interaction (HCI), the interdisciplinary field of Animal-Computer Interaction (ACI) aims to materialize meaningful (graphical) interfaces for specific species.<sup>53</sup> According to Clara “ACI can keep CHI [referring to the annual conference on Computer-Human Interaction] healthy by reminding it of what Haraway calls the “foolishness of human exceptionalism”. ACI belongs at CHI because HCI is ACI” (Mancini 2013:9). ACI has grown in the past years in Europe and the US by studying animal-machine interfaces (Savage et al. 2000) and designing with and for animals (McGrath 2009). Note the distinction between animal technology and technology informed by Animal-Computer Interaction. As explained by Clara, “animal technology [is] any technology intended for animals, whose development is not necessarily led by user-centred design principle. [On the other hand, technologies informed by] Animal-Computer Interaction [are] the explicit and systematic application of design principles that place the animal at the centre of an iterative development process as a legitimate user and design contributor” (Mancini 2013:2). A game called Cat Cat Revolution (2011), a positioning system in Human-Canine Interactions (2011), a mobile pet wearable computer and mixed reality system (2006), and a canine alarm system designed by Charlotte Robinson (a doctoral researcher of the ACI Laboratory at the Open University) comprise sound examples of ACI. Asking for whom new materials for computer

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<sup>52</sup> I unpack the concepts of assemblage and apparatus in chapter 5 and sketch with them two modes of grasping screens.

<sup>53</sup> Using quite a different vocabulary, I believe Robert E. McGrath from the National Center for Supercomputing Applications of the University of Illinois makes a similar point about the interfaces created by HCI and ACI: “ultimately, these systems seek to create understandable and pleasurable experiences across radically different conceptual views, to create a virtual world that makes sense to participants with dramatically different behavioural and cognitive repertoires, with significantly different motivations, and even different time scales. This virtual world must then be “rendered” to and from sensory and motor events in species specific mappings” (2009:5). Species matter.

interaction are being developed, I came in touch with ACI after reading Clara's Manifesto for ACI (2011) where she states the aim, ethical principles, benefits, and agenda of her grasp of the field. In my own view, "interfaces" for "species-appropriate computer mediated interaction" (McGrath 2009) may be reimagined in less anthropocentric ways, in order to be more in line with the functional requirements and lively needs of non/human animals. But as discussed below with Charlotte's canine alarm system, ACI may tap as well into the creativities and affects expressed in such collaborations.

Research methods to decentre the human in favour of human-animal relations in user-centred design have been discussed by exploring how sensemaking (meaning) happens across species with multispecies ethnography (Mancini et al. 2012), or by sensing interspecies social awareness; for example, through methods that foster "*pawticipatory design, labradory tests, and canid camera monitoring*" (Mankoff et al. 2005:1).<sup>54</sup> Such efforts resonate with the insights of animal geographies and the touchy-feely ethnography unfolded above, since they commonly nominate less anthropocentric ways of thinking about people and things, including non/human animals. Science and technology studies may be tuned for such purposes as well, resulting in approaches to (human) animal and machine relations which can rely on a kind of dancing or juggling with their becoming (human) animal and machine. Note that it was with the sensibilities proposed by these methodological inputs that I grasped the plot of biodetection dogs screening cancer at MDD, where humans and dogs become in touch and stay in contact by working and playing together in contact zones: where "all the dancers are redone through the patterns they enact" (Haraway 2008:25). Since contact zones are webs of interdependence with open-ended edges, similar detailed readings that grasp the plots of people and things becoming with and through each other can focus on the architextures resulting from the dances threaded by the partners. Note that such readings do not require allocating a "centre" to place species specific "users", but rather by

<sup>54</sup> See also Kirksey and Helmreich (2010) on multispecies ethnography.

following a course of action and focusing on the textures and architectures (of screens), readers grasp how parties juggle with becoming (human) animal and machine.

Charlotte's canine alarm system is a phone that affords the possibility for a trained dog, assisting a human in an emergency situation in the household, to call for aid by sending text messages or making phone calls to emergency numbers, family members, neighbours, etc. If nobody else is present in a domestic site to support an assistance dog (when a human partner suffers, for instance, a diabetic coma) then a canine alarm system made for them can become helpful. Charlotte's prototype is not designed for dogs to bark over the line, but rather to communicate an emergency by interacting with the a computer which sends an alarm message or text. In this way, following Clara, the system is informed by animal-computer interactions and Charlotte has tried to devise various textures to articulate the semiotic trades between assistance dogs and her immobile device. One of these textures covers a tuggy-toy Charlotte has added for these dogs to pull with their mouths in order to seek help (figure 26). The toy is attached to a chain with a texture that matters as well, for the resistance of the toy to the force applied by the dogs while pulling with their mouths. Following John Law and Marianne Elisabeth Lien (2013), these textures are immanent and specific to relations and interdependencies threaded by human partners and their assistance dogs: "The textures of the relations that make up the webs of practice characterise whatever is caught up in them. They differentiate animals from one another" (Law and Lien 2013:6). They may differentiate, as well, animals from machines. In this sense, animal-computer interactions can be understood as a becoming with by threading, or knotting and cutting, the material qualities and boundaries of (human) animals and machines. Defining things as caught up in the textures they produce emphasizes how the becoming of either humans or nonhumans is at stake when non/human animals meet machines.<sup>55</sup>

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<sup>55</sup> The distinction between people and animals is made in practice, insofar "practices enact people and animals together" (Law and Lien 2012:8)

In contrast to biodetection dogs screening diseases in the lab, assistance dogs go around different kinds of circuits than those outlined by a carousel with distinct positions. Here dogs become part of a screening task not by facing metal plates, but by aligning themselves with apparatuses whose ontological portfolios take them into account as nonhuman “users”, e.g. apparatuses to assemble and devise species specific emergency responses, while texturing and enfolding them into a web of relations of humans, dogs, and machines. These “architextures” pattern the practical achievement of interfacing partners, as a juggling with the becoming of (human) animals and machines. Again with Law and Lien, these architextures are choreographic. They are the textures of choreographies (think about greeting rituals as setting up the dance floor to constitute a polymorphous polis when and where species meet). Architextures “have to do with ordered arrangements [of relations within and between practices] The latter extend across space [...] And they also extend across time” (Law and Lien 2013:7). In later chapters I focus on sensing the timing and spacing of arrangements around, through, and away from screens. But for now let's spend time grasping the architextures of Charlotte's phone by detailing the moments of movement around, through, and away from the tuggy-toy.

I had the opportunity to witness this phone in action during the Summer Science Exhibition of the Royal Society (London 2014). There, Charlotte and Clara, along with more researchers from the Open and Lincoln Universities, accompanied by the staff and also the dogs from the charities Medical Detection Dogs and Dogs for the Disabled, were all invited to demonstrate their work-in-progress with technosciences made with and designed for dogs. Charlotte's canine alarm system was immobilized (attached) to one of the large white panels framing our stand branded “technology for dogs” (figure 27). Her phone was exhibited as one example of ACI. I had a chance as well to cooperate here by helping to talk about technologies for dogs with the “public”. (At the end of that

long week the script I crafted by repeatedly going with people around the stand, showing them the many ongoing studies and prototypes, had more elements of anthropology, sociology and politics than of design, computing, and psychology). From a video shown along with a simulation of a prototype of Charlotte's alarm system, I borrow figures to describe the actions of assistance dogs around, through, and away from the tuggy-toy. I discussed earlier the audiovisual format of a public demonstration of technology. Now I detail how a course of action textures and enfolds the moments in which a human, a dog, and a machine may "become with" each other, through situations whose architextures bend around, through, and away from Charlotte's canine alarm system.

**Figure 26.** Charlotte's canine alarm system  
(photograph by author)



**Figure 27.** At the Royal Society exhibit  
(photograph by author)



The video shown as part of the exhibition was produced by collaborators in the ACI lab of

the Open University. It was filmed at MDD and features Lydia acting a diabetic coma (falling on the floor, becoming unconscious) and Lucy going around MDD (the household), pulling the tuggy-toy attached to Charlotte's phone, and bringing it back to comfort Lydia as well as herself. Note these four moments are part of an open list of movements of the course of action, which may happen otherwise. Since no breakdowns are shown in the video, Lucy responds promptly and goes smoothly around, through, and away from the alarm system back to aid Lydia. For Lucy a s(t)imulated circuit may begin when Lydia drops to the floor and in this specific moment the relation between Lydia and Lucy is marked and affected by Lydia's sudden immobility and immutability: by her unconsciousness texturing a "becoming still" that Lucy tastes when she approaches to kiss her face (figure 28). This works also as a release sign through which Lucy detaches herself momentarily from Lydia, or to put it von Üexkull terms, their Umwelts are separated.

**Figure 28.** Sensing Lydia's texture  
(image taken from the ACI lab video)



**Figure 29.** Pulling the tuggy-toy  
(image taken from the ACI lab video)



Lucy traces next a moment of movement towards Charlotte's canine alarm system, threading a meandering passage around the textures of the architecture of MDD, staged as a household. Here, it is through Lucy's patch-work of putting together moments of movements choreographically that a web of relations between her and Lydia may be further textured and enfolded in architextures that include Charlotte's canine alarm system. Such notable passage is edited out from the video, skipping to the next moment when Lucy approaches the tuggy-toy, performing a division by pulling it away, and so cutting it apart from a box that contains an "Arduino" processor (figure 29).<sup>56</sup> This small computing device reacts to the detachment of the tuggy-toy by sending a text message or making a phone call (figure 30). It is the separation of the toy that allows Lucy to trigger the alarm system, and eventually draw the attention of a family member or neighbour to their screens and the emergency situation. This division screens the situation by creating a text(ure); moreover, it is by juggling the tuggy-toy between parties that the dog and the screen may become significant for each other, they may become a dog and a screen for one another. Articulating the care dogs have for their human partners, this apparatus creates a digital screen that makes sense for Lucy to care for Lydia; furthermore, the creativities of this moment of movement open up an exit passage through the architextures of the course of action for Lucy to go back to Lydia (figure 31). Together, apart, together again – this is a multipartner dance of knotting and cutting together apart, all the way down.

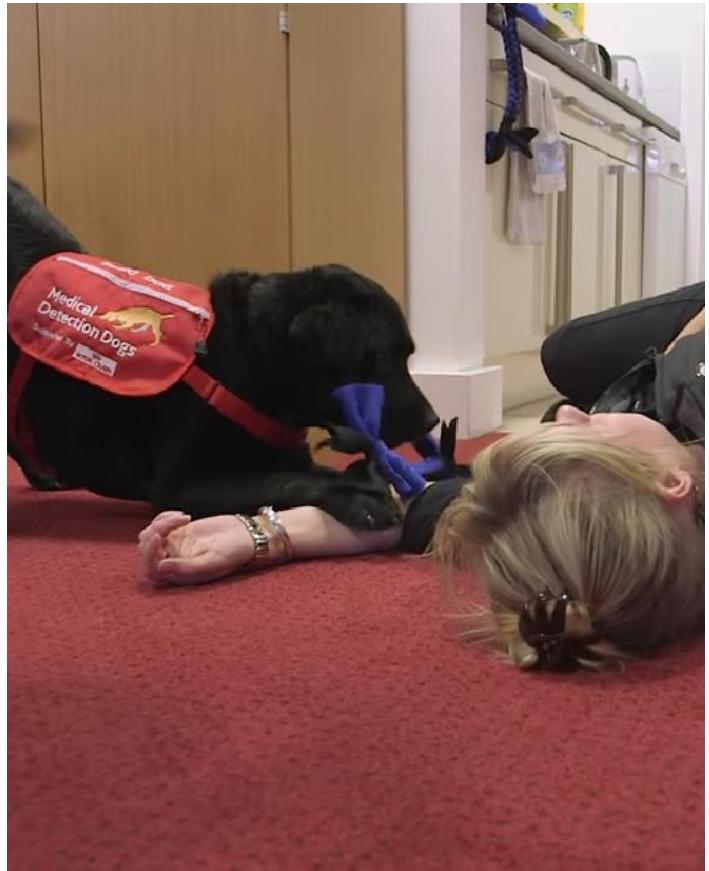
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<sup>56</sup> The alarm system includes a Raspberry Pi B+ and Arduino Leonardo. "The Arduino was used for input and output control and the Pi to control audio and internet connection" (Robinson et al. 2015:341).

**Figure 30.** Making a phone call  
(photograph by author)



**Figure 31.** Caring for Lydia  
(image taken from the ACI lab video)



Again, in contrast to biodetection dogs screening cancer, assistance dogs face not an apparatus for medical research (at least not in the video looping during the Royal Society exhibition) but an emergency situation that may be stressful for them – in sites where the care (rather than the authority) expressed through human-dog relationships becomes articulated and reconfigured with an apparatus that includes a screen in the architecture of this contact zone at MDD. Aligning a screen in ACI arranges a patchwork of moments of movement, in which (human) animals and machines become meaningful for each other. By grasping such courses of action in the making of their webs of relations, we refigure the human and nonhuman as a distinction of lived texture, fleshed or aligned without centring their agencies around a single species.

## **Chapter 5. Folding my office**

I depart now from my friends at MDD, but highlight once more a key insight that I explored with them: screens are alignments made in action that arrange significant displays (bringing cancers or emergencies into view, leaving other things unnoticed). The displays of cancer and emergency, what is brought into view with dogs, can be felt as a “texture” (Law and Lien 2013) or quality that characterizes the partners in the partner's web of relations. I examine the divisions of screens next, to think about their limits as un/en/folded or stretched beyond their displays. I discuss how paying attention beyond displays contributes to studying screens, by situating two screens in my office's workplace and unpacking them with the writing of the chapter. While writing I detail my mode of grasping these screens as part of a fold that I call my workplace. To complement the allegory of my workplace as a fold, I address with the help of assemblages and apparatuses what these screens bring into view and what they leave out of sight. These concepts emphasize how actions can articulate screens, enveloping them within multiple and heterogeneous arrangements. The notion of action as assemblage articulates screens as performed, while arrangements read as apparatuses of bodily production delineates enactments of screens as parts of open-ended configurations. For Haraway, making a living disciplines action as patterns of aligned sequences, but play disrupts these recurrences.<sup>57</sup> Here, I tinker with her point by doing alignments with two screens named Vig and Ben. I share my performance of such alignments with them, where “I” articulate how “we” hang together by displacing one another, knotting and cutting the limits of our actions and arrangements at my workplace.

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<sup>57</sup> “Play makes an opening. Play proposes... Functional patterns put a pretty tight constraint on the sequence of actions in time... The sequences in a serious conspecific fight or in any other of the important action patterns for making a living are different but no less sequentially disciplined. Play is not making a living; it discloses living. Time opens up” (2008:240).

## Grasping displays

How have we grasped so far the displays of screens? In chapter 3, with the example of Google Glass, we considered how screens, when seen as single surfaces, produce observers that appear to attend exclusively to the figures displayed. They miss something about the screens they are looking at, something that is left out of sight, by confining themselves to the display. Against such occulo-centric reduction of the screen to the display, we began to grasp screens as practical alignments, bringing something into view and leaving something else out of sight. In chapter 4, with the cases of dogs screening cancer and collaborating in the design of screens in Animal-Computer Interaction, we detailed how such alignments may be articulated by humans and dogs, making screens by assembling a course of action around, through, and away from the cancer samples and the canine alarm system.

If textures display people and things, but leave something else out of sight, screens in animal-computer interaction entail partnering up in order to unfold the actions that bring something into view,<sup>58</sup> and enfold something else that is left unnoticed. Unfolding actions, enfolded into arrangements. What is the fold? It's a figure to draw boundaries, the insides and outsides of people and things, always in-the-making, sorted in practice rather than prefixed. Therefore, by unfolding I mean that the partners thread the actions through which they become meaningful for one another in a web of relations, and by enfolding I suggest that screens can become significant in animal-computer interaction, insofar they help partners to relate to one another within that web of relations. The figure of the fold features prominently in Leibniz's philosophy. Here I follow Geoffrey Bowker's 'plea for pleats' (2010). For Bowker, the fold as allegory can help science and technology studies to remain mindful of the multiplicity and the insides and outsides of technoscience (2010:123-139). The fold may be useful to think about sociotechnical devices. I grasp my

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<sup>58</sup> The Oxford English Dictionary tells us that the middle English terms unfurl and unfold are etymological roots of the word display.

workplace with folds as performed and performative of the insides and outsides of two screens. Drawing on studies of screens in workplaces (Luff et al. 2000, Knorr Cetina and Bruegger 2002), I focus on two screens as part of my workplace grasped as a fold, to sketch my ongoing ways of performing the workplace's boundaries, of un/en/folding them with the display of screens.

According to Bowker's assessment of science and technology studies, particularly when inspired by social constructivism, there appears to be a tendency to "avoid philosophizing and valuing: our task, it seems, as social students of science is to represent their categories [the categories of those under study], not to develop our own" (Bowker 2010:123). Bowker then introduces Leibniz's fold as a metaphor to make a way of reading science – pleats would keep nature and culture undivided, folded onto each other when studying them. If his plea can be extended to sociotechnical devices, our grasping of screens will propose to look at displays as alignments – bringing something of nature undivided from culture into view, but leaving also something else out of sight, separated from view. Here my workplace is what screens help to assemble in my office by knotting or putting together people and things around this office I share with fellow students. In this way I'll read, with the concept of assemblage, the unfolding of my workplace. Complementing this reading, I'll grasp with the concept of apparatus what I sense screens divide and conceal as enfolded beyond them, around and away from their displays. Considered together, unfolding and enfolding enable an account of screens as alignments.

I find the notion of assemblage – taken as a method for making present the hinterland of relations that "generates presence, manifest absence and Otherness" (Law 2004:42) – attractive for reading screens as bringing something into view. John Law's concept of assemblage helps to address screens without reducing them to their display, supporting a closer engagement with the methods that we need to approach these material configurations. I also find the notion of apparatus

helpful, taken as a method to make present the hinterland of relations. Apparatuses can be understood with Michel Foucault as arrangements of light and shadow, most famously in the figure of the panopticon (1977). They resonate with an understanding of screens as concealing something strategically, while bringing something else into view. In this sense, I take apparatuses as a method to address the hinterland of relations of screens, a diffractive method informed by Karen Barad's reading of Foucault's apparatus through a realist ontology borrowed from physicist Niels Bohr. For Barad, apparatuses are about interfering and messing with what I read as Law's hinterland of relations – “apparatuses are specific material reconfigurings of the world” (2007:142).

Let's begin to grasp the hinterland of screens with the help of Natasha Myers' work on crystallographers, giving a body to and having a feeling for molecules (2008). Myers studies the body-work of crystallographic model-building: of constructing, manipulating and so embodying protein models in the lab. Her detailed account of molecules, crystallographers, models, and computer screens being unfolded through the modelings of chemists and their own molecular embodiment of proteins, points us to practices and stories where bodies and matter co-produce bodily volumes:

As she [Diane] tells the story, she contorts her entire body into the shape of the misfolded protein. With one arm bent over above her head, another wrapping around the front of her body, her neck crooked to the side, and her body twisting, she expresses the strain felt by the misshapen protein model. “And I'll get this pained expression”, she tells me. “I get stressed just looking at it... It's like I feel the pain that the molecule is in, because it can't go like that!” She feels compelled to fix the model. She mimes a frantic adjustment of the side-chain by using one arm to pull the other back into alignment with her body, tucking her arms in towards her chest and curving her torso over toward the core of her body, demonstrating

the correct fold. With a sigh of relief, she eases back into a comfortable position in her chair. The comically anguished look on her face relaxes back into a warm smile (Myers 2008:165).

Myers narrates in this thickly descriptive passage how intimately Diane, a professor of chemistry, head of a crystallography research lab, embodies a protein that she feels has been misfolded badly in a model.<sup>59</sup> Note that Myers corporeal take on Diane's affective, molecular embodiment proposes that models do not exist in the hand or in the head, as Ian Hacking distinguishes them (1983:216). She describes instead the material and conceptual meshing of models in the modeler's embodied imagination (2008:165). Her point is that crystallographic models may not only be inscriptions displayed on screen: "More than visual traces, marks or inscriptions, three-dimensional physical models explicitly blur the boundaries between automated machinic production and the skilled work of scientists, and between the intellectual and physical labor of research" (2008:169). Myers' idea of unfolding as giving fleshy volume to models, of modeling by embodying, dissolves the notion that models are sufficient to represent protein foldings. Antti Salvast proposes that Myers' corporeal work can inform studies of screens when used to display markets. For Salvast, body-work is "a resource – or in other words, a form of 'screening' – when using a control room computer monitor. This observation corresponds with other case studies on computer-based civil engineering work (Suchman 2000) and modeling of proteins with computer software (Myers 2008)" (2011:162). Likewise, I see my body-work of writing as a mode of grasping screens in my shared office. Thinking with Myers, I will refer to my workplace as assembled by unfolding or giving volume to figures, like icons, modeled for and through the displays of screens. Body-work is a way to grasp what screens bring into view. In this way I

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<sup>59</sup> A protein acquires a characteristic fold when a polypeptide changes from a random coil into a functional structure. Myers body-work elicits the reversal of the process of protein folding as embodied or unfolded by the body-work of chemists.

apprehend<sup>60</sup> my workplace as an embodied articulation – where I perform screens without well defined limits, as I am produced by the actions that make me hybrid collectif (Callon and Law 1997).<sup>61</sup>

I will complement this grasping of the display of screens – on the other hand – with my fingereyes sensing what screens leave out of sight.<sup>62</sup> Fingereyes is a portmanteau I learned from Eva Hayward (2010), to express how we may proceed whenever we attempt to grasp the ways in which screens relate to wider apparatuses of bodily production. Hayward tells us, in a paper on cup corals or *Balanophyllia elegans*, grasped at a lab in California, how they are “full of touch, of sensing, or rather of being literally tact, touch; their tentacular senses – their fingereyes – respond to surface effects, caressing. [The] being of cup corals is a haptic-sensory apparatus” (2010:577).<sup>63</sup> Like *B. elegans*, if screens may also be about being touched, how can we grasp them as companions, equipped with disparate optic-haptic sensations? I use Hayward’s fingereyes to explain the tentacular visuality of cross-species encounters and to name the synaesthetic quality of materialized sensation. Perceptions are moved (affected) by the movements and actions that they

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<sup>60</sup> This apprehension is inspired by Whitehead's prehension, which is a de-centering of the mind in the question of perception in philosophy. “Where Berkeley speaks of the mind, Whitehead will speak of a process of prehensive unification and generalize it to all that exists” (Stengers 2011:117). For Whitehead the individual is creative nexus, the concrete passage of elements, insofar an element names anything “that has parts and is a part, but also that has intrinsic features, we say that the individual is a 'concrecence' of elements” (Deleuze 1993:88). We encountered in chapter 4 the three characteristics that Deleuze attributes to Whitehead's prehension. First, a datum is expressed in a subject as behavior, affect, conscience, perception, or emotion by way of a knot, from datum to datum. Second, by prehending screens as event, or equating screenness with the geneses of an event, the passages between datums articulate the display of screens. Third, satisfaction appears then as a “final phase, as self-enjoyment, [marking] the way by which the subject is filled with itself and attains a richer and richer private life” (Deleuze 1993:98). We read how dogs and humans enjoyed collaborating around the samples to screen cancer, because Whitehead's sense of enjoyment formulates the satisfaction, according to Isabelle Stengers, of interpreting “conjointly (that is, without opposition, hierarchy or disconnection) what we usually describe in mutually contradictory terms, for example, freedom and determination, cause and reason, fiction and reality, or mind and matter” (2008:104).

<sup>61</sup> Similar to the notion of texture, hybrid collectif is a term that locates agency in heterogeneous webs of relations. Individuals are collectif for Michel Callon and John Law, but collectifs are not collections of individuals: “a collectif is an emergent effect created by the interaction of the heterogeneous parts that make it up” (1997:98).

<sup>62</sup> We could stay with my body-work to grasp what screens leave out of sight, maybe in a rhizomatic way. But I prefer to approach screens with fingereyes. They help me to reach into the ways in which people and things are touched back by what screens conceal.

<sup>63</sup> Steven Helmreich suggests in How Like a Reef (2010) that “the idea of reading coral represents an opportunity for reconstructing our understanding of the cultural and scientific politics of the sea — or, better, for reconfiguring such understandings, since coral must be read not simply or only as a sign, but as a *figure*” (as part of the series Party Writing for Donna Haraway, <http://partywriting.blogspot.co.uk> last accessed 13-12-15)

provoke in other organisms. Stirred by the ripples of investigation that emerge in the arrangement that we may touch, senses are amalgamated, superimposed, forging cross-species reticulations and sites of solid-arity (Hayward 2010:580).

Hayward is addressing multi-species touch with her fingeryeyes in the case of humans, animals, and machines of “different sight, sense, sensibility, and sensuality” (2010:580). It is the overlapping of the senses that – for Hayward – makes fingeryeyes “diffract seeing through touching; optical groping, or tactful eyes, haptically and visually orient the sensual body across mediums” (2010:582). I think Hayward's fingeryeyes elicits, with the sense of being touched, Haraway's unfixed species “becoming with” each other, the open-endedness of specie and the possibilities for all people and things – named, or not, as human or non human – to become companions. I consider in this way that screens, when they touch people back, can enfold or envelop them into larger, multiple, and heterogeneous arrangements. Being touched by screens entails a chance to apprehend them as differential companions to species. This denotes screens, following Haraway, as parts of “webbed bio-social-technical apparatuses of humans, animals, artifacts, and institutions in which particular ways of being emerge and are sustained. Or not” (2008:134). Haraway's apparatuses should not be taken as disembodied infrastructure. They are arrangements that condition the possibility for the (re)production of knowledge (1991:197) and techno-biopolitics (1991:208). Her notion of apparatus is tuned to situate and so visualize the hinterland of relations through which bodies grow across mediums, folded onto each other or enfolded into arrangements that figure them in specific ways. In this way arrangements can be grasped as apparatuses of bodily production, and fingeryeyes as a sensuous device that helps to bring into view the arrangements hidden by screens when they enfold people in places such as offices.

Below, with the work of my body writing and my fingeryeyes interrogating some of the larger arrangements that make these lines possible, I will read the unfolding of my workplace through the display of a discarded screen I named Vig, after picking it up from the bins in my Department. And I will grasp the enfolding of what builds my workplace with the display of a screen I named Ben, after a friend gave it to me before leaving the Department. We will discuss respectively with Vig and Ben what screens bring into view by focusing on the writing of the chapter, and what they leave out of sight by moving away from my office and considering my workplace at home. The notions of assemblage and apparatus will connote the stories as well as suggest modes of touching and being touched by screens. With Vig and Ben I convey my own reflections on reading, grasping, and so becoming response-able for encountering and receiving screens.

### **Unfolding Vig**

Vig appeared next to the Sociology Department's bins closest to my office in Lancaster University (figure 32). Vig is bulky when compared to thinner and lighter screen technologies. This is why someone threw Vig away, I thought, or maybe Vig does not work anymore; it was abandoned there because of this, perhaps a student finished her research and dumped Vig, had no need for it anymore and abandoned it. Maybe Vig does work and this, I presumed, could be what I need in order to pick up screens, to grasp them through encounters. Speculating in this way I took Vig from the bins and made space for it on my desk. The circuits worked and Vig has stayed with me since then. I named this screen Vig by alluding to its brand, Viglen Ltd.

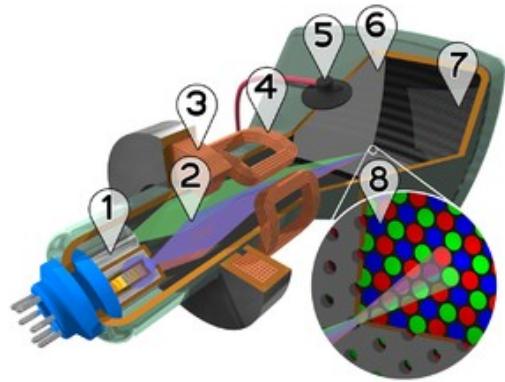
While considering whether to study Vig, María Puig de la Bellacasa convinced me that relating and caring have conceptual and ontological resonance (2012:198). But I don't care for

discarded screens like Vig so much out of nostalgia. I feel more preoccupied by not wasting their material components. Their considerable size matters. Vig takes up lots of space, though I can manage to make a place for it, there cornered against the wall next to the window. Yes it does remind me of the many hours I spent with such screens, playing computer games when I was younger. Vig is a screen that I found. That circumstance made me feel responsible for it. Still bringing Vig into my office helped me to consider it as an addition to a particular workplace. Offices exist in many kinds. And offices are situated as well as part of wider apparatuses of production, tied to different workplaces. So, I think with Vig about my office as one of many workplaces where people spend long hours making a living around, through, and away from screens.

**Figure 32.** Vig  
(photograph by author)



**Figure 33.** Cathode ray tube  
(Wikipedia's CRT entry)<sup>64</sup>



Moving things around a desk is part of the productive activity of a workplace. Desks in particular make great spaces to work as people use them to associate things, in places such as

<sup>64</sup> 1. Three electron guns (for red, green, and blue phosphor dots) 2. Electron beams 3. Focusing coils 4. Deflection coils 5. Anode connection 6. Mask for separating beams for red, green, and blue part of displayed image 7. Phosphor layer with red, green, and blue zones 8. Close-up of the phosphor-coated inner side of the screen

workshops, homes, or offices. Planes or trains may have tables that can be used as desks to construct a workplace. Latour notes how desks seem to be hubs of productive units (1979:48), laboratories in his case, putting together materials and texts coming from outside the lab (e.g. electricity, scientific publications) with those coming from the inside (i.e. experimental results). Likewise, by placing Vig on my office desk, it would become part of a productive nexus, an academic hub limited by a personal workplace within a shared office. This includes the usual suspects of the academic office space: a chair, a desk with drawers, printed articles, books, a calendar. While the edges of this desk help to outline the limits of my workplace, my things sometimes end up on the desks of my friends with whom I share the office. Still it is such an assemblage of things that belong to a workplace that I want to call a fold, which envelopes a spacing. I imagine it as stretching a passage. A snapshot of the fold in question: consider how incorporating Vig into my workplace required me to hold it firmly, walk with it, and so by embracing it, literally to bring Vig into the office. By way of this alignment Vig became part of my workplace. Then I left Vig on the chair, looked around and thought it would be impractical, considering Vig's size, to place it against the wall on the centre of the desk. A better alignment turned out to be against the corner. And through these alignments, some things, including Vig, became un/en/folded (linked) within the situated arrangement of things of an office that is my workplace.

In short, to pick up Vig demanded that I pay close attention to the practical alignments of people and things of this office. I have referred, so far, to that attention to screens taken as alignments of surfaces in terms of a juggling with, to say how screens cannot be grasped by reducing them to single frontal surfaces. As I proposed in chapter 3, to juggle with screens one has to attend rather to contingent alignments of surfaces. In this sense my juggling with Vig was not over after placing it on the chair. To fire up Vig, I had to shove aside a pile of printed articles,

notepads, and scattered cables. While making enough desk-space for Vig, I knelt to plug its cord into the electrical circuit. The power plug was saturated but I found a power strip with available plugs nearby. Vig's display, still disconnected from a computing device, showed a message: no input found. The image appeared blueish but the message was readable. I had no PC to plug in at the time. I experimented during that week with Vig by trying to set up a clone, to copy the haptic display of my mobile phone – in the same way a digital display may be cloned on a large flat surface, for instance, before a conference presentation. I stopped carrying my laptop after that during my summer walks to campus. I wrote in the office with Vig, my mobile phone, and a wireless keyboard. I made a draft of this chapter that way but someone took my phone during fieldwork in Milton Keynes. I managed to get a good grasp of Vig's textures, before Ben came along.

Let's note what I grasp when I work with Vig by unpacking its cathode ray tube (CRT). CRTs are electron “guns” embedded in vacuum tubes aiming at a fluorescent surface (figure 33). They act as a source of electrons emitting a beam which passes through means to accelerate and deflect the electrons, creating an image on the surface. CRTs owe their large, deep shapes to vacuum tubes made usually of lead glass. The inner side of a CRT surface is often a coated-phosphor layer with green, red, and blue zones. Pixel-images are created through magnetically controlling the intensity of the electron beam, while the front area of the tube gets scanned (a pattern called raster). Note that these displays made with CRTs during the Second World War became at the time closer to radars, having less to do with entertainment than with military surveillance.<sup>65</sup> Whenever I work with Vig, I get a feeling of its CRT. Spending time with Vig generates in me a particular impression of being in my shared office, where I unfold or enact practical alignments. For example, the CRT inside Vig can display these words with a kind of

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<sup>65</sup> The first computer games (“Tennis for two” and “Space Wars”) were respectively played on an oscilloscope and a radar-like round CRT screen (Gere 2006:147-149).

texture, which helps me to perform the atmosphere of my workplace, taken as a fold. More specifically, I edit this chapter by using the toolbar icons of a writing software which has a particular texture given by my juggling with Vig. I grasp the icons, click them, cutting, pasting, acting them out to write the chapter. Eliciting this atmosphere of my workplace is a way of signalling that workplaces are performed. And in this sense Vig can be unfolded as part of an atmosphere by making alignments that bring textures into view (leaving something else out of sight).

Talk of a fold's atmosphere captures the liveliness of articulating practices or embodying actions. In other words, what I feel is not just by being an observer of Vig's display, not only by looking through or reducing my attention to a single surface. I'm not just clicking on icons by interacting with figures modelled for computers. My body-work unfolds the icons around Vig, articulating a wider course action that includes the moments when I click them. Consider, for example, how such unfolding may commence when I approach Vig, aligning myself with the surfaces surrounding us. Who and what goes by the name of all of "us" here: Vig, myself, mouse, window, desk, chair, or stapler eventually becomes part of our juggling, but without saying in advance who juggles with whom. This is one way of grasping Vig – as event, as assembling electron beams materializing a display of digital figures, embodied through and around Vig's display. Drawing on Myers, I make sense of my embodiments of Vig's on-screen icons – of operating systems modelled for phones (like "Android"), personal computers and laptops (like "Ubuntu"). With Myers' sense of the embodiment of three-dimensional models, I give a body to figures like icons modelled for computers, assembling them beyond their flat display on screen, extended by my eyes and hands touching, sliding, clicking, and so acting these icons out three-dimensionally.

Of course there are many more models to (mis)fold; not just operating systems, but software based on various coding practices, as well as algorithms running on disparate computing machines. In any case, I begin by moving around Vig, folding a workplace in my office, to articulate Vig's display – because an alignment to give a body to the toolbar icons can start a moment before placing my “self” in front of “the” screen.<sup>66</sup> Meeting Vig fills my office with connected events knotted to the event of performing my workplace. Here both Alfred North Whitehead and Gilles Deleuze delineate a way of giving Vig a body, wherever events unfold courses of action (Whitehead calls them passages of Nature) that make of screens non-singular events.<sup>67</sup> According to Deleuze's reading of Whitehead's concept of event, screens interestingly feature as that which allows events to emerge. “Events are produced in a chaos, in a chaotic multiplicity, but only under the condition that a sort of screen intervenes. [...] Like a formless elastic membrane, an electromagnetic field, or the receptacle of the *Timaeus*, the screen makes something issue from chaos, and *even if this something differs only slightly*” (1993:86 *italics in original*).<sup>68</sup> If we grasp Vig's display of icons as an event that helps me to unfold my workplace, where does this alignment end? I think that when the limits of screens cannot be well drawn the boundaries are made in practice – this is the point I want to make by grasping Vig's on-screen figures as event.

This is a move to counter the tendency to reduce screens to single surfaces, restricting attention to their displays by portraying the screen as an interface. In order to avoid getting stuck with this (mis)representation of screens, I suggest that we grasp them in practice as contingent

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<sup>66</sup> As discussed in chapter 3, the tendency to see screens as single surfaces regards people as users placed in front of the display.

<sup>67</sup> We stray into the philosophy of events to talk about digital icons by asking how to account for their configurations when I give a body to them beyond their display. Screening icons with Vig as a contingent alignment of surfaces would eventually unfold a pattern of connections, knotting people and things together. Note that extension is Deleuze's first condition or component to embody (patch) entities, grasped eventually as “waves of alterity” infinitely sequencing courses of action, endlessly overflowing the boundaries or blind spots attached to people's senses (see chapter 3). Once icons are considered as events around events, properties of the alignments of Vig's display may be seen as divisions bringing the icons into view, intensions rather than extensions, the second component of events. Intensities then “enter on their own accord in new infinite series” (Deleuze 1993:77).

<sup>68</sup> Chaos, events, and screens, whatever they may be, would always come together into existence. “Chaos does not exist; it is an abstraction because it is inseparable from a screen that makes something – something rather than nothing – emerge from it” (Deleuze 1993:86).

alignments of surfaces that assemble something into view, following John Law, by making something present, leaving something out of sight as manifestly absent, while Othering something else (2004:14).<sup>69</sup> Let's read then with Vig how these boundaries of my workplace are enacted, how its insides and outsides become unfolded in practice by bringing something into view and leaving something else out of sight. A snapshot of the boundaries in question: to write these lines with Vig I sit at my desk, tap the keyboard, pause, read, erase – sipping from a cup of tea. Then I turn myself around, and leave the cup next to the window, breaking face-to-display contact with Vig. While the vapor of the tea condenses on the glass, I approach a shelf to look for a book and come back to the desk, never leaving the fold of my workplace. Stretching it around Vig, I keep myself momentarily in touch with the things at my desk.<sup>70</sup> Thus if we think now about its boundaries, my workplace does not have one definitive shape. In practice what belongs inside the fold – that is, what belongs to my workplace at one moment – is open-ended in relation to the next. So while working with Vig, some things of my workplace were made present, by telling you about my movements; some things were made manifestly absent, like the floor, by giving them a contextual character; and some things were Othered – for example, when I was working with Vig and drinking tea, note that the window became a part of my workplace.<sup>71</sup> Affixed to a thick frame holding the cup of tea, the window assisted the writing of the lines by helping at that moment to hydrate me. Therefore not only bounding the office but aligned by working with Vig, the window mattered in the unfolding of my workplace. The same goes for the shelf of the office, when the passage of the action of writing became extended around Vig. I got up, found the book, and came back. Like a road unfolded through a tunnel, my workplace was stretched through the office. And through this practical

<sup>69</sup> What is made manifestly absent, in relation to what is made present, can be understood as contextual; in other words, presence and manifest absence are both textures made in practice; and Otherness can be understood as texturing, too, a wider hinterland of what can pass unnoticed in a situation, such as the work of screens at a workplace.

<sup>70</sup> As the book I took, Donald Hislop's edited collection on *Mobility and Technology in the Workplace*, tells us by echoing John Law (2002): "objects [and subjects] rely on two spatialities for their perpetuation. On the one hand, they require stability in Euclidean space. On the other hand, they require stability in what [Law] called 'network space'" (2008:19). I talk about the timings and spacings of the people and things of supermarkets and banks in chapters 6 and 7.

<sup>71</sup> I discuss below how Othering things that matter for my workplace also means to miss the apparatuses at work in Lancaster University.

assembly of my workplace, Vig can be left out of sight as well. Even when Vig's CRT is turned "on", the display can be made manifestly absent or Othered, placed at the limit or outside of my workplace.

## **Enfolding Ben**

The grasping of a course of action with a screen may be felt as flowing the other way around: not unfolded and so enfolded in subjects, but enfolded in (as a part of) an apparatus of bodily production, thus unfolding subjects and objects too into alignment. Alignments of this kind may be understood as a particular method of assembling screens. They become useful in grasping how devices may be central for apparatuses revolving around the exploitation of people and things. Let's consider that flip of the winding flow of action with a screen I named Ben after Li-Wen Shih – a dear friend of mine in the Sociology Department – finished her research and gave me her LCD screen (figure 34) and a cactus she did not want to abandon.

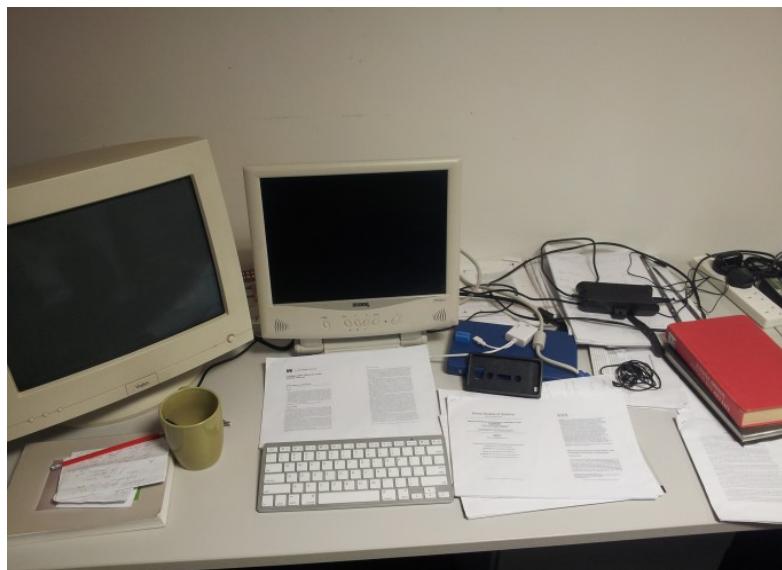
Ben's material components are lighter and thinner compared to Vig's cathode ray tube. Named after the brand – BenQ – Ben has a frontal surface made with liquid crystals to display digital images. Liquid crystal displays (LCDs) are a quite common screen technology – only matched in popularity today by displays made with light emitting diodes (LEDs). Ben's smaller size makes it easier to place on my desk. Note how CRTs and LCDs show images differently. The latter may use ambient light, but LCDs frequently include a back-light lamp, commonly a cathode fluorescent lamp.<sup>72</sup> LCDs can be called flat panel displays because they laminate adjacent layers of materials (figure 35). Liquid crystal is an interesting word denoting matter acting as a liquid and a

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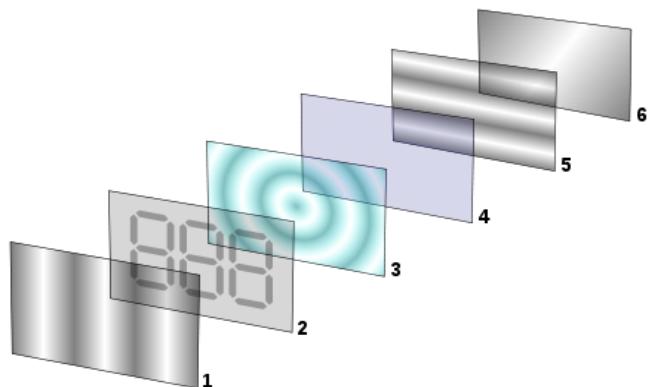
<sup>72</sup> The variety of components has quickly become daunting. To make an extensive account I would have to tell you something about ionized gases (plasma displays), thin-film transistors, cold cathode fluorescent lamps, glossy effects, video graphic adapters, aspect ratios, resolutions, contrast, gamma, and refresh rates, plane line, in-plane, and advanced fringe field switchings, vertical alignments and viewing angles, pixel-pitch, lag, as well as black levels.

solid, and molecules flowing between these states, so they may become oriented and polarized in specific positions. This serves to modulate beams of light traveling through the laminated surfaces in which liquid crystals are coated. Different phases classify the ways in which liquid crystals may be arranged. Note, for example, when affected by high temperatures, how some liquid crystals go into an “isotropic phase” – causing molecules to flux randomly and to interfere with the display of on-screen images.

**Figure 34.** Vig and Ben  
(photograph by author)



**Figure 35.** Liquid crystal display  
(Wikipedia's LCD entry)<sup>73</sup>



“Nematic” is another phase of liquid crystals, within temperatures that make it possible to electromagnetically manipulate the molecules into parallel positions, torquing them along that axis to bend (shape) the light passing through them. This is called a (super) twisted nematic field: in super mode the molecules are torqued in greater angles, a key feature to enhance the precise use of

<sup>73</sup> 1. Vertical filter film to polarize the light as it enters. 2. Glass substrate with ITO electrodes. The shapes of these electrodes will determine the dark shapes that will appear when the LCD is turned on. Vertical ridges are etched on the surface so the liquid crystals are in line with the polarized light. 3. Twisted nematic liquid crystals. 4. Glass substrate with common electrode film (ITO) with horizontal ridges to line up with the horizontal filter. 5. Horizontal filter film to block/allow through light. 6. Reflective surface to send light back to viewer

liquid crystals for image display. One patent for this effect was first filed in 1970, but work with liquid crystals had commenced almost a century before, framed at the time as a material curiosity. Since the 1980s LCDs began to be produced in industrial quantities and eventually outnumbered CRTs when “electronic industries recognized that the dream of the wall-hanging television had become a reality” (Kawamoto, 2002).

Barad uses diffraction as an optical metaphor and a physical phenomenon to understand apparatuses through an approach that she calls agential realism. This ethico-onto-epistemological methodology is about diffraction. Unlike reflection<sup>74</sup> diffraction is a method for addressing the conditions of mattering: making differences that matter within patterns of matter and meaning. Diffraction aptly points to entanglements of spacetime, of spacetime mattering in its ongoing re(configuration) (2007:223-246).<sup>75</sup> Therefore note that it is because of the entangled natures of visualization and touch, as dynamically reconfiguring (altering) the conditions of possibility for behavior, affect, conscience, perception, or emotion, that I can diffractively co-produce with my own fingeryeyes what matters for the possibilities to inhabit with Ben the larger arrangements (apparatuses of bodily production) that make our conjoined articulation of any course of action (im)possible.

Ben touched me as soon as Li-Wen appeared with it in my door. I took it, and had to displace things on my desk again for this screen that I received with all the pleasures of an

<sup>74</sup> Diffraction is about overlapping waves and the formation of interference patterns. By thinking with diffraction, Karen Barad and María Puig de la Bellacasa have followed and expanded Haraway's suggestion of working with interference patterns and diffraction (as exchangeable tropes), to avoid onto-epistemologies based on images of reflection and reflexivity that figure knowledges as practices to isolate (mirror) nature or culture. Both are optical phenomena but diffraction does not reflect either nature or culture. So while diffraction portray knowledges and their consequences as situated naturalcultural practices of becoming with matter and meaning, reflection imagines knowledges as abstract, observational practices, where matter and meaning become fixed and transparent proxies of nature and culture.

<sup>75</sup> By making diffractions Barad rejects the assumption that there are determinate objects with determinate properties and corresponding determinate concepts with determinate meanings, preassigned independently of the conditions needed to resolve the inherent indeterminacies posited by the measurement of phenomena. Barad proposes the neologism intra-action to coin her view of the entangled nature of nature and culture as “naturecultures”, echoing Haraway (1991, 2008).

unexpected gift. Later I borrowed a PC from another department friend, Liviu Alexandrescu, manufactured also by Viglen Ltd. I plugged Ben to this, and connected both to the local area network (LAN) and the Internet. Now I work with Ben when I leave the laptop at home. Diffractively reading these screens, they appear to push each other and mutually exclude one another, while I juggle with their digital figures, fleshing them out, and becoming evidently enfolded by them, by their textures now enveloping the office through Ben's display, intersecting my body, stretching my "self" and "the" screen away, into wider apparatuses of production. This is another way of grasping Ben – as phenomena arranging liquid crystals, materializing digital figures that I embody through and around Ben's display. In this way with Hayward I make sense too of Ben's on-screen figures. Here my fingereyes twist, cut, and so extend, prosthetically, the fold that is my workplace, the daily pocket I inhabit, into crossed overlapping directions, enfolded by apparatuses that most times prearrange looping sequences (circuits). With them, I take note of what I repeat on a daily basis while I work with Ben (e.g. turning its display "on" and "off"), to go through or unpack the consequences of unfolding my workplace.

Here is a snapshot of the entanglement in question: like Vig, Ben is made with various materials which I can account for, by stretching this study into the practices of the manufacture of plastics, metals, or glass. Such materials are extracted and crafted together by apparatuses of production that I may grasp by moving away from Ben, but without losing touch with how they make sense for me: by helping to show what Ben displays as part of my workplace. While displaying these lines, Ben is energized through an electrical grid whose particular history of production and distribution I may unravel. At my workplace these industries overlap with the commercial, pedagogical, and legal apparatuses – to name just a few – at work in Lancaster University. Grasping a screen like Ben as phenomena, to consider the various arrangements entangled with its display, entails reading this workplace diffractively through the apparatuses of

bodily production that enfold Ben and me, helping us to become cuts of a specific academic<sup>76</sup> apparatus.

As Barad notes, this sort of cut is both ontic and semantic (2007:148), an agential cut differentiating people and things around my office. It determines the boundaries and properties within the meaningful screenings of Ben's digital figures. Agential cuts are “specific material (re)configurings of the world through which the determination of boundaries, properties, and meanings is differentially enacted” (2007:148). Barad understands these cutting practices as material-discursive ones, insisting that concepts can be materialized by apparatuses and their articulation of objects and objectivity. In particular, these practices are intra-actions,<sup>77</sup> through which specific determinacies, along with complementary indeterminacies, are enacted with the phenomena produced, bringing forward entangled matters and meanings made in open-ended configurations. Barad's framework sets as her task to rework and stretch Niels Bohr's philosophy-physics, as an epistemology where the agencies of observation cannot be subtracted from the phenomena they help to enact.<sup>78</sup> In her agential realism, objectivity (as attributed not solely to objects) refers to becoming accountable for marks on bodies, for specific materialities in their differential mattering.

I can account for Ben in this way by noting how it matters to diffract my workplace differently. Take the case of taking Ben home; that is, to switch it off, to disconnect the video graphic adapter from the PC, and to unplug Ben from the electrical circuit, to wrap it up very

<sup>76</sup> As mentioned in the acknowledgements, I pursue a PhD in STS under a scholarship scheme called Becas Chile, managed by Conicyt, the National Committee of Science and Technology of the Government of Chile. The scheme frames the recipients as advanced human capital in higher education and legally binds PhDs (“the investment”) to return to Chile for four years or more. As an international student in Lancaster, I also have a Tier 4 visa provided by the UK Government.

<sup>77</sup> The nature of the possibility of interference and the study of the marks that entities leave on each other's bodies as they matter, including our own marks and markings as humans, is captured in Barad's material-semiotic neologism intra-action (2007:149).

<sup>78</sup> “We are responsible for the cuts that we help to enact not because we do the choosing (neither do we escape responsibility because “we” are “chosen” by them), but because we are an agential part of the material becoming of the universe” (2007:178).

carefully, to lift it firmly with my arms, and to leave a dust-mark on the surface of the desk. Relocating Ben by detaching it from my workplace, I'd move then out of that fold, managing somehow to close the office door behind us. After heading to the Uni underpass bus stop and commuting with Ben placed on my lap, we would walk for twenty minutes to my home, Ben traveling firmly in between my arms. And once again struggling to open the door, we would (finally) arrive home – go in, down a small corridor, turn left and enter a studio with a wooden table, a room arranged as an office in a friendly house I share with more people. Relocating Ben here would entail not only to detach it from a place, and to dynamically reattach it to another: underpass, bus, street, studio. Threading this course of action with Ben also means to cut the apparatuses that would make it possible, to make a difference that enfolds Ben differently, in another workplace, cutting it from the apparatuses at work on campus, through those that make possible my commuting back home; only to attach Ben as part of those state and domestic apparatuses that would allow me to unfold my workplace, now stretched like a passage of the house.

Screens feature at the heart of Barad's main examples of how agential cuts dynamically (in)determine the conditions of possibility and separability between apparatus and phenomena (people or things). These are mostly borrowed from experiments in quantum mechanics that demonstrate how (paradoxically) electrons and photons (i.e. matter and light) can act either as waves or particles. Here screens are placed as grating screens (endowed with gaps-slits) and detection screens, as parts of apparatuses that agentially cut and so separate the agencies of observation from the phenomena observed: matter or light acting as wave or particle. Barad includes classic examples of experiments in quantum mechanics – Thomas Young's two-slit experiment, Einstein and Bohr's *gedanken* experiments – as well as her own quantum eraser (delayer) experiments; all featuring screens (2007:79, 82, 101, 103-105, 266-267, 307, 314).

Interestingly one example, the Gerlach-Stern experiment, exhibits what Barad calls a “smoke screen” enacted by Stern’s cigar-smoking habits acting as a significant part of the apparatus – aiming to find traces of space quantization but eventually providing evidence of the spin of electrons: “The cigar is a ‘condensation’ – a ‘nodal point’, as it were – of the workings of other apparatuses, including class, nationalism, economics, and gender, all of which are part of this Gerlach-Stern apparatus” (Barad 2007:167). Barad is diffracting and cutting the Gerlach-Stern apparatus through other apparatuses, through the cigar grasped as a nodal point; much like Whitehead’s prehension, formulating and knotting events through other events. In a Bohrian ontology the point is then to grasp phenomena through their constitutive exclusions (cuts). In a Whiteheadian ontology, on the other hand, the point is to grasp events through their seized inclusions (knots). Nevertheless, just like Deleuze’s reading of Whitehead appears to suggest, Barad’s reading of Bohr never posits the boundaries of screens as intrinsically fixed, but apprehended as a diffraction that blurs sharp edges, while still determined to make precise screenings.

## Knotting and cutting

An attentive reader may have noticed already that these senses of knotting and cutting assemblages and apparatuses, respectively tied to events and phenomena, have been lurking in between the lines of the previous chapters. This mode of thinking about complementary yet mutually exclusive arrangements with screening devices (which I evoked in chapter 2) then suggests how screens shake<sup>79</sup> our assumptions about touching them as single surfaces, by reorienting our attention to the moments of movement around, through, and away from their displays. This way of studying screens attends to hinterland (his)stories that unfold how their

<sup>79</sup> In chapter 3 we discussed how to shake off the trend of reducing screens to single surfaces by looking with Emma at screens, around and away from them, and not only through their displays. Such shaking can be grasped with Merleau-Ponty’s sense of flesh as well as with Barad’s entanglement of agencies and objects of observation.

alignments make sense, and to arrangements that enfold the possibilities of aligning screens. Reading screens within folds allowed us to distinguish their multiplicity and differentiate their possibilities of inclusion and exclusion. In this sense, I unpacked with Vig and Ben stories of screens at my workplace. We detailed the body-work of incorporating Vig into my workplace, reading its boundaries as unfolded by further knots or inclusions. And we also grasped with fingereyes what screens leave out of sight by detaching Ben from my shared office and then (re)imagining the boundaries of my workplace as enfolded into the underpass, the bus, and the streets by further cuts or exclusions. I was inspired to grasp screen in these ways by Maurice Merleau-Ponty's (1962) notion of flesh, discussed in Jannet Vertesi's work on *Seeing Like a Rover* (2015) as embodied seeing. For Vertesi the team members that steer the Mars Explorer Rovers would "not project themselves outward, into the body of the rover as human proxy. Rather, they themselves adopt the rover's bodily apparatus with its unique bodily sensitivities in order to understand and interact with Mars" (2015:176). Alluding to Merleau-Ponty example of a blind person, Vertesi is contrasting the ways in which a stick can be manipulated or apprehended to navigate the local surroundings (fold). Consider how by tapping on the nearby surfaces to grasp them:

the blind man's stick has ceased to be an object for him, and is no longer perceived for itself, its point has become an area of sensitivity, extending the scope and active radius of touch, and providing a parallel to sight. In the exploration of things, the length of the stick does not enter expressly as a middle term... To get used to a hat, a car or a stick is to be transplanted into them, or conversely, to incorporate them into the bulk of our own body. Habit expresses our power of dilating our being-in-the-world, or changing our existence by appropriating fresh instruments (Merleau-Ponty 1962:143).

It is this function or position of an alignment with things to navigate places that makes them

no longer objects, for Merleau-Ponty, but parts (to say it with Barad) of the agencies of observation of an apparatus. And in this sense I unfolded the action of (re)writing the chapter through Vig's display. Conversely, by touching around instead of through the "stick", anyone enfolding the Mars Explorer Rover or Vig may apprehend them as objects of the focus of an observation:

To see an object is either to have on the fringe of the visual field and be able to concentrate on it, or else respond to this summons by actually concentrating upon it [...] The two operations do not fortuitously coincide [...] It is necessary to put the surroundings in abeyance the better to see the object, and to lose in background what one gains in focal figure . . . because objects form a system in which one cannot show itself without concealing others (Merleau-Ponty 1962:78).

I enfolded Ben in this way by grasping my workplace as an open-ended configuration, whose assembly I fleshed out by locating us as cuts of the apparatuses at work in Lancaster University.

Note then by grasping around and through Vig we articulated movement as unfolding or knotting attachments, while we moved away with Ben from my shared office to my home by enfolding or cutting detachments. In this way we distinguished assemblages from apparatuses. During my juggling with Vig, the moments of movement around, through, and away from its display did not appear so sharply differentiated by cuts. They were unfolded together, added, annexed, knotted by way of a passage that I took as a practical enactment of a workplace, a "recursive self-assembling, in which the elements put together are not fixed in shape, do not belong to a larger pre-given list but are constructed at least in part as they are entangled together" (Law 2004:42). The notions of assemblage and apparatus allowed us to read Vig and Ben as event and

phenomena. Maybe because of their conceptual similarities and differences, they are helpful in rejecting modes of grasping without folds or dividing and reuniting nature and culture through synthesis of processes. Building on this complementarity of assemblages and apparatuses, that allowed us to grasp my encounters with Vig and Ben, these notions have been helping me to detail how actions with screens flow both ways, by signaling the handedness of alignments.<sup>80</sup> It might be useful to discuss agential realism as a method that would also make entities manifestly absent and Othered (Law 2004:84-96); maybe as a specific account of heterogeneity that focuses on “unambiguous communication” (Barad 2007:115, 174, 339) of mutually exclusive yet complementary phenomena.<sup>81</sup> This entails further groundwork as well as speculation to better situate all sorts of material-semiotic actors, enfolding and unfolding one another.

In the chapters that follow I continue exploring material figures to annotate, with assemblages and apparatuses, the unfoldings and enfoldings of screens aligned in specific situations. In particular we have been sensing so far moments of movement by learning how to move sideways in order to grasp and so articulate screens. In chapter 6 and 7 I apply this lesson to expand on how people and things unfold and enfold actions around, through, and away from the screens of the supermarket self checkout machine and the automated teller machine of banks. In chapter 6 I study the course of calculative action with self checkouts by unfolding moments of movement around, through, and away from them. Likewise, in chapter 7 I investigate the course of financial action with automated tellers by enfolding moments of movement around, through, and away from them. Complementing one another, the unfolding of knots features in chapter 6, while

<sup>80</sup> By handedness I mean the opposite orientation of human hands i.e. their chirality. “Human hands are the most universally recognized example of chirality: the left hand is a non-superposable mirror image of the right hand; no matter how the two hands are oriented, it is impossible for all the major features of both hands to coincide” (Wikipedia’s chirality entry retrieved from <http://en.wikipedia.org/wiki/Chirality> last accessed 26/06/2016).

<sup>81</sup> Barad’s reading of Bohr’s complementarity implies a mutual but generative exclusion: an agential cut through a measurement that separates the agencies of observation (the effect) from the features of objects (the cause). An exemplary case is Young’s double-slit experiment (see also Plotnitsky 1997:134-172). Relations of mutual exclusion and complementarity of phenomena account for how matter and bodies “differentially materialize as a particular pattern of the world as a result of the specific cuts and reconfigurations that are enacted” (Barad 2007:176)

the enfolding of cuts characterizes chapter 7.

Note that I might also read self checkouts with cuts and automated tellers with knots, but exchanging assemblages and apparatuses does not undermine their combined use to study screens – it increases the kinds of thoughtful readings of relations that matter for the stories told in both chapters. I include two further figures (khipus and pukaras) to highlight knots in chapter 6 and cuts in chapter 7. These figures are not Euro-American. One reason to work with such Inka figures, following Law, is to stress that – perhaps – “Euro-American culture doesn’t really have the language that it needs to imagine possibilities of this [fractal] kind” (2002:3): the kind of non singular screenings we have been studying, during moments where what matters before/after placing ourselves in front of a display relates to movements around, through, and away from a screen. In this sense the stories that follow use topological figures to study the timing and spacing of screens.

## **Chapter 6.** Supermarket self checkouts

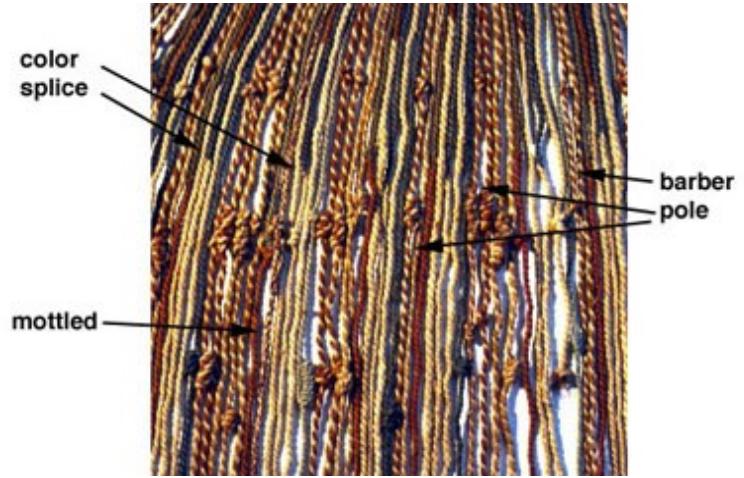
With supermarket self checkout machines (figure 36) this chapter defines the notion of calculation as a knotting practice, by considering a sense of calculation borrowed from an Inka device called khipu. Khipus are talking knots. One talks with them by making knot-numbers. Khipus need to be knitted to calculate. Note the knots have to be un/tied from the strings – in specific positions – to designate numbers (figure 37). Khipus were used in the Inka Empire for accounting purposes in demographic, military, or agricultural surveys. Khipukamayuqs (knot maker/reader, knot-authority) would wear khipus around their necks (as accessories) and be summoned to narrate with their own fingereyes the knotted stories folded into them. Khipus remind us to stay in touch with our accounts, to pay attention to the figures enfolded into the material and semiotic knots people and things use to calculate. Thus by reading self checkout machines with khipus, I suggest in this chapter how people and things, while moving around, through, and away from self checkouts, remain attached to the consequences of calculation in supermarkets.

Checking people and things out in supermarkets depends upon a wide range of actions from both shoppers and machines – and from the entangled gestures of other actors such as employees assisting the purchase, or the baskets/bags carrying the goods. Breaking down this bundle of actors, attached to interactions with the graphical displays of the self checkout machine, situates the chapter in the longer history of supermarket self service practices. By grasping and folding an open list of moments of movements, I attempt to extend here our calculative imagination of supermarket stories.

**Figure 36.** Self checkout purchase point  
(photograph by author)



**Figure 37.** Khipu with multi-colored cords<sup>82</sup>  
(khipukamayuq.fas.harvard.edu)



With my *fingeryeyes*<sup>83</sup> (Hayward 2010), I will argue that self checkouts participate in configuring the temporalization of the spaces where calculable goods are collected in the supermarket, and where they are subsequently carried outside (e.g. to the public street). I will examine in detail how self checkouts are a part of action on the shopping floor, as people collect goods around the aisles, when they queue to pay for their collected goods, when they (struggle to) articulate self service purchases, and when they move away from supermarket buildings with the goods they have purchased. And I will discuss how to stay in touch with such a distribution of agencies, enabling and troubling the computing and screening of automated purchases, by grasping the knotted circuits of this collective market device (Muniesa, Millo, and Callon, 2007).

The sense of the market as a collective device proposed by Michel Callon and Fabian Muniesa (2005: 4) defines markets as encounters of actors that calculate compromises on the values of goods and services. Such collective devices are assembled in supermarkets by putting into

<sup>82</sup> A khipu's threads are cut with specific lengths, arranged and coloured to signify different values. Importantly, making numbers with khipus entails both knotting digits and enfolding accounts into threads, particularly accounts of people and things.

<sup>83</sup> See chapter 5.

practice encounters with algorithmic configurations, a phrase coined by Callon and Muniesa to insist that economic algorithms cannot be defined in the abstract, i.e. “independently of the conditions and the material limits of their execution” (2005:26). This chapter draws on Callon and Muniesa to propose two arguments about the algorithms of self checkouts in the configuration of super-market devices. These algorithms are designed for self service practices to screen purchases, which in turn bounds the calculative apparatus of the supermarket. These algorithms may be further reconfigured by abstracting the calculative space of the supermarket into a situation where the whole calculative apparatus may become assembled on a computer screen, as is the case when people shop for groceries online.

If online the shopping floor may become a website, and the queue line a delivery list, the machinic purchase computes and screens the insides and the outsides of the supermarket all through the graphical interfaces of desktop, laptop, or mobile devices. Yet if we make a purchase with a self checkout, the insides and outsides of the supermarket are calculated and displayed through, but also around and away from the graphical interface of the machine, which in turn bounds the shopping floor and queue lines. So, both practical cases differentially compute and screen the supermarket. They assemble the self service zones and passages of this calculative apparatus. Because shoppers encounter multiple ways of attaching/detaching themselves while moving goods with super-market devices, in order to better grasp the assemblage of the various ways of knotting the cuts, of cutting together/apart the algorithmic configurations of self checkouts, I break down the moments of movement with such market devices into four chronotopes (Bakthin 1981). The chronotope in this context is a fusion of spacetime co-produced with the graphical displays of machinic purchases, and the alignments and detachments of goods from supermarkets.

## Cashing in

A number of self checkout ‘purchase points’ are aligned in front of the bench where I am seated. These belong to a local supermarket in Lancaster, UK. I came into this place two hours ago, dripping water from the rain pouring outside. It is Sunday. The supermarket will close in three hours. People pass by pushing carts, carrying hand baskets. The bench located near the main entrance is made of wood; I sat there to see people using the touch-screens of self checkout machines (to pay for their groceries). But then I became curious about the practical perimeter between the spaces designed to collect goods in here, and to carry those goods out there. I began to look at how self checkouts help to enact the insides and outsides of this place, wondering about the moments when people differentiate and move along these spaces, by taking these machines into account.

But just looking from afar was not enough to grasp how this supermarket might become bounded. I got up and went shopping with my eager fingeryeyes. One by one I selected goods around the aisles, using a basket I picked up earlier. Then after making my way through the shopping floor, I approached the zone where the self checkout machines are located. There I bumped into a short queue. Usually at peak times, I thought, there would be more people. I scrutinized other shoppers while queueing. They were holding hand baskets or some hand held goods. Shopping carts are not allowed in this self checkout zone. Neither is buying more than fifteen items. After making my way through the queue line, I approached one of the available machines and put the basket with goods, or the items for the machine, on the left side. Here I became “the user for the machine”. I gestured with the modelled capacities of its algorithms screened on the display, and with the machine’s pressure sensing, item scanning surfaces. To start a purchase, I grasped the graphical interface and touched a button. The self checkout then asked me if

I had my own bags. If so, one needs to place them on a surface attached to the right side. At this point the machine appeared ready to scan the items. I turned around the goods to find the codes on their surfaces, and then I aligned them with an infrared scanning device.

After the machine signalled with a beep that an item had been scanned, its description appeared on the screen. When buying fruits or vegetables the weight of the items has to be measured. I signalled this by choosing an option from the haptic display, and by placing these items on a second surface with a pressure sensor just below the touchscreen. Then I put the correctly scanned items on another pressure sensing surface, attached to the right side of the machine. After scanning the goods I had to selected one payment method. Cash, credit or debit cards are the most common options. Slits for coins and bills are often cut into self checkouts. Devices to read credit or debit cards tend to come attached to the machines, which may also ask shoppers if they have a loyalty card provided by the supermarket for repeat customers. The machine then reminds me to collect my items. Although this process of purchasing goods seemed automated, an employee typically lurks around the machines to assist shoppers with their purchases, or to confirm their ages if buying alcohol. It turns out such assistance is frequently needed.

When passing by the self checkouts or the cash registers of a supermarket you may find yourself immersed in a kind of restless noise. When in use, self checkouts beep and utter words a lot. Almost every interaction and any infraction is followed by a sound. I could close my fingereyes and more or less thoroughly describe a purchase just by listening to the machine. I know that someone has become a user for the machine when she aligns herself with a self checkout, and places her finger on the touchscreen to start a purchase, because then it says “please scan your items”. Every time an item is scanned the machine will beep – if the item is not placed afterwards on the surface attached to the right side, I hear the self-checkout say “please put the item in the

bagging area". These words are repeated obnoxiously until you comply. In all the machines I've encountered, this voice has a female tone. And when someone touches the pay button on the touchscreen, the machine will voice a demand to select a payment method. After the user is done with her payment, it would tell her to collect her items, and then it would thank her for buying at that specific supermarket. All this beeping echoes the attention demanded by the sequences of gambling machines (Schüll 2012).

These atmospheres that affect my fingeryeyes at the self checkout machine may be more broadly unpacked within the history of supermarket encounters that enfold the shopper in self service practices. The basket still in my hand reminds me of how collecting the goods in the supermarket was not always the business of the shopper. Before self service practices in the supermarket, there were counters with mechanical or electromechanical cash registers, where a customer would meet a shop assistant whose job was to collect the goods and assist customers through the purchase. When self service practices were introduced in 1916 by a US grocery shop called Piggly Wiggly (*The Independent* 2011), the design of the store (figure 38) began to articulate the movement of shoppers around the goods by unfolding shopping floors with aisles around the shelves, tagging the sections and prices of the goods, and designing into the self service store a radically different sensorium for people to experience the shopping floor and the purchase point.

There's a story of a scandal when Lord Sainsbury brought the concept of self service to the UK in 1950. The new layout of the shop provoked a response from a high society shopper – a judge's wife – who threw the basket violently at Lord Sainsbury when she realized that she was being asked to do the work of a shop assistant (*The Independent* 2011). But at the same time, according to the online report of the Woolworths Supermarket museum,<sup>84</sup> the new concept had diverse benefits – "improved customer service with no need to wait at each counter, leading to

<sup>84</sup> <http://www.woolworthsmuseum.co.uk/1950s-firstselfservice.htm> (last accessed 17/06/2016)

larger average purchases; more space to sell merchandise and fewer tills and service points where needed; and labour saving by having fewer people tied up ringing up customers' purchases a single item at-a-time" (Woolworths website). This online museum curates the large transformation of a grocery shop into a self service store in Cobham, Surrey. It walks us through the ways in which the new layout in 1955 relocated the checkouts desks at the front of the store, providing baskets and signalling "in" and "out" doors, acquiring cash registers that could add up purchases, as well as "taller counters with more products on sale."

**Figure 38.** The Piggly Wiggly self service store in Memphis, Tennessee, 1917  
(Wikipedia's Piggly Wiggly entry)



**Figure 39.** Employees at Woolworths' first self service store in Cobham, Surrey, 1955  
(woolworthsmuseum.co.uk)



Interestingly, the museum's website mentions as well that "each British director had reservations about self service and feared that Cobham shoppers would consider the approach un-British." Here I am struck by the similarity of this statement with another passage of *The Independent* news story on self checkouts where I learned about the incident involving Lord Sainsbury,<sup>85</sup> which adamantly points out that the machine signals "a trip to the supermarket which

<sup>85</sup> <http://www.independent.co.uk/news/business/analysis-and-features/how-britain-became-a-self-service-nation->

involves no interaction with other human beings whatsoever: a population for whom a robot-voice chanting 'unexpected item in the bagging area' has become the rage-inducing mantra of 21st-century shopping." While I would agree from my own experience that people might sometimes use self checkouts to avoid contact with other people, the case is that this self service practice is also always enacted in ways that are more or less fragile, depending on the gestures and capacities at play during the machinic purchase. Assistance from a human employee, in turn, is not only often required, but queues around the self checkouts also entail a kind of intimacy, a feeling of proximity.

The assistance needed when an interaction with a self checkout machine breaks down resonates with the assistance customers may need on the shopping floor as well. Here the Woolworths museum's website informs us that, when the new layout of the Cobham self service store was introduced, scripts were memorized for women employees (figure 39) to deal with the complaints of customers, and a series of slogans and messages were hung up to explain how it all worked. According to *The Independent*: "for a while, customers were guided around the shelves by an employee, known as 'the hostess', in order to alleviate the anxiety of being lost in this bewildering new environment" (2011). The self checkout as an innovation of supermarket self service practices may indeed generate a bewildering new environment. It seems as yet unclear just how this machine may reshape the supermarket self service practice of grocery shopping.<sup>86</sup>

Among the reasons cited to provide these beeping money machines are their promised increase in efficiency and speed for a customer to checkout. For retailers they would seem to be attractive because they require fewer employees, and could help to free up space on the shopping

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[2241830.html](#) (last accessed 16/06/2016)

<sup>86</sup> Studies (RBR 2009, 2013) by a retail banking research company have stated there were 27,000 shipments of self checkout machines in 2012, and forecast nearly 60,000 by 2018. The studies say that the Asia Pacific had a prominent growth in shipments in 2012, with Australia and Japan being the largest markets. The US remains the largest region. Sales are expected to spike in 2013, as a result of a major rollout by Wal-Mart. Some figures on manufacturers are also given: NCR corporation is today the largest vendor of self checkouts, adding up to 70% of global shipments in 2012; the next largest world supplier is Wincor Nixdorf (13%), delivering most of its machines to western Europe; Fujitsu comes in third place (8%), selling units mostly to the US.

floor. On the other hand, opponents claim that they are not necessarily faster than staffed cash registers, they are difficult to interact with, they restrict personal contact between people, and they allow novel ways to shoplift (BBC 2009).<sup>87</sup> I aim to entangle to the knots of the history and controversies around self service supermarkets with my own ethnographic stories. If enacting the supermarket by ourselves means translating the work of shop assistants or employees to shop customers or consumers, these stories are about the co-production of people and things as employees, customers, and goods. By grasping this plot with my fingeryeyes I make sense of what is configured for people when they touch the haptic interface of the self checkout machine, and I trace the bodies and boundaries that we inhabit in the supermarket, to attempt to respond to self service practices by moving sideways from their displays.

### **Breaking chronotopes**

According to Susanne Bodker (1990: 22), a breakdown of the human-computer interface arises in a situation where a practical conflict signals a loss of articulation between “the assumed conditions for the operations on the one hand, and the actual conditions on the other; between the human reflection of the material conditions, and the actual conditions” (1990:27). This approach adopts a definition of a breakdown based on an epistemology informed by geometrical optics. Breakdowns occur when, like a crack on a mirroring surface, what becomes actualized does not reflect what is assumed in the design of an interaction through a human-computer interface. But if we pay attention to how an ongoing breakdown is articulated in practice, the register of such situations may also catch how people tend to move sideways from machines to grasp/look for ways of resuming an ongoing interaction.

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<sup>87</sup> For instance, a man in Los Angeles “walked into the local Walmart, grabbed a 42” Sanyo Plasma TV, removed its price tag and affixed one that would scan for only \$4.88. He then proceeded to the self checkout where he paid \$4.88 for the TV. When he was stopped at the door, he produced a receipt for a TV he had purchased earlier that day. His plan was to then return the TV he purchased earlier and keep the one he paid \$4.88 for” (The Consumerist 2007).

A breakdown means not a stop, but a sideways shift of action. Note that breakdowns signal distributions and alignments of agencies: when something breaks down or is broken down, what forms a part of a collection becomes reordered. In a mundane sense, to maintain, repair, or recycle broken things is to put them together differently. Insofar as breakdowns always reconfigure actors within dynamic situations, their reorderings might be grasped by taking apart the constitutive course of action into its moments of movement. Breakdowns of the supermarket – including breakdowns of the interaction with a self checkout machine, and the self checkout machine as a breakdown of the supermarket – can be articulated into particular chronotopes. I use Mikhail Bakhtin's sense of the chronotope as a time and space amalgamation where people and things, driven by particular narratives, experience and experiment with living impulses and form-shaping ideologies. Chronotopes are historical, a chronotope is a place “where the knots of narrative are tied and untied” (Bakhtin 1981:250). They are as much about genres as they are about production. Chronotopes tell stories that generate times and spaces to render material specific configurations of people and things. “Time, as it were, thickens, takes on flesh, becomes artistically visible; likewise, space becomes charged and responsive to the movements of time, plot and history” (Bakhtin 1981:84). Chronotopes remind me of the promotional genre of Google Glass, audiovisual materials animating on a single screen, seemingly without trouble, haptic envelopments and ubiquitous automations of mobile displays. Chronotopes are material-semiotic fusions of time and space dovetailed into each other, cut together apart around, through, and away from one another. Chronotopes partly resonate with Albert Einstein's space-time in relativity theory: “what counts for us is the fact that it expresses the inseparability of space and time” (Bakhtin 1981:85, cited in Morris 2009:184).

Chronotopes resonate beyond their application in literature, with a sense of TimeSpace developed by Jon May and Nigel Thrift (2001) in geography. What matters is how chronotopes

handle time and space: as generative of practices and generated in practice. Insofar as time and space are produced everywhere, “the means by which a particular sense of time comes into being and moves forward to frame our understandings and actions – are in turn both multiple and dynamic” (May and Thrift 2001:3). Ordering time through distinctions like the A-series and B-series of time (the former sorts out time in terms of past, present, and future, while the latter in terms of before/after (Gell 1992:149-190)) not only reduces time to a cultural construction of temporal maps and images, with the risk of affixing its relation to space, but also cuts short the list of instruments and devices to flesh out time, the way it is materialized through multiple social disciplines, text(ures), timetables, and rythms (May and Thrift 2001:4-5), which open up in turn ways of denoting moments of time. Bergson's sense of duration, mobility and time taken together, in particular, points to moments without a pre-given extension, or impossible to articulate in fixed series of time – such as days, weeks, and years in calendars; or seconds, minutes, and hours in clocks. Bakhtin's chronotopes precisely capture time's multiplicity and heterogeneity in the way series of time cannot. It appeals to the practical situatedness of a story's action to distil modes of timing from the doings of people and things; for example, stories of what takes place in the queues and shopping floors of supermarkets co-produce different practical modes of timing, which cannot be reduced to one another.

For Bakhtin, chronotopes do not designate time and space as transcendental categories that enable cognitive subjects to somehow go beyond the materiality of objects. They are rather narrative realizations of the quantities and qualities of time and space for particular people and things. Chronotopes entail motifs to inhabit more than mathematical abstractions. Or “to be more precise, the concept of time and space as mathematical abstractions itself defines a specific chronotope that differs from other chronotopes” (Morson and Emerson 1990:367). Chronotopes bring forth the productive variety of genres, their space-time generating capacities. According to

Morson and Emerson, “for Bakthin, what is true of geometries of space is also true of chronotopes. We live, so to speak, in a universe of heterochrony” (1990:368). Chronotopes unfold passages of time where dominant stories become merely one alternative within a wider set of possibilities. They are for Bakthin the ground for activity, not solely present or subjected to representation but rather what makes it (im)possible (Morson and Emerson 1990:367). The suggestion of a chronotope is a chronotope, a way of making by telling time and space. When we make our stories, there would be no escape from (thinking with) chronotopes.

I approach the agential multitude of chronotopes by storytelling with my fingereyes. I take hold of chronotopes to account for the supermarket in terms of a co-production of shopping stories, people, and things associated with the courses of action of the displays of self checkout machines. I focus, more specifically, on the computer screen of the self checkout, to grasp how this money machine can become a part of supermarkets by aligning self service shopping practices. I am inspired by the work of Suzanne Fraser on queues for methadone maintenance treatment (2006), and her use of chronotopes in conjunction with Karen Barad's sense of intra-activity. In the context of the methadone dosing point, Fraser sets out to explore how “the specific actions of time and space coproduce each other as a chronotope of the queue, and how this chronotope helps materialise particular methadone subjects” (2006:193). Focusing on the waiting periods of the queue; that is, a specific temporality of the methadone maintenance treatment, one that is not strictly distinguishable from other parts and forms of life, Fraser wants to avoid a distinction between a normal temporality against which a methadone temporality that materialises undesirable (unproductive, disorderly, or illicit) subjects may be contrasted. To do so, she takes into account how actions around the dosing point fold back into the chronotope of the queue, considering with Barad's intra-activity how time and space are constituted together in ways that do not pre-exist people and thing. Space, time, subjects, and objects rather co-produce each other, so chronotopes are not taken in her account as

ground for consciousness, but as encountered in their specificities (Fraser 2006:194).

With these insights we can begin to grasp breakdowns as signalling the variety of times and spaces through which courses of actions around, through, and away from the displays of self checkouts can be assembled. Breakdowns are not effected by the misalignment between what is actualized and assumed in a course of action. They are rather a product of the ongoing genres and the shifting generations of chronotopes reconfiguring the distribution of agencies of people and things. Specific subjects and objects, like methadone and retail junkies, are always produced as parts of chronotopes, and they may breakdown and deal with the breakdown of the parts of a chronotope by moving entities, including themselves, around or away from it. The breakdown of face-to-face interactions, and of interfaces of all kinds, invite us to move sideways from the confrontation of people and things – either within a particular time and space or into another dovetailed chronotope. All of these subtle moments of movement depend on what we do with our stories, and how we may respond and become responsible for their powerful geometries of time, plots, and history.

## **Market devices**

Shopping stories make the supermarket a noteworthy example of a mechanism of sorting, for people figured as consumers and things figured as goods (Callon and Muniesa 2005:1235). The supermarket articulates the history of a calculative space in which goods can be related and compared by shoppers. A selection of goods must happen because this space is not infinite, it has a boundary which means that some goods are displayed on the shelves, other goods are deposited in the background of the shopping floor, and some goods are excluded from circulating within the supermarket altogether. These arrangements may be iteratively ordered by three elements that

would define supermarkets as organized collective market devices: calculable goods, calculative agencies, and calculated exchanges (Callon and Muniesa 2005:1231).

Market devices point to a pragmatic turn in the study of market and economic activities (Appadurai 1986; Cochoy 2007; du Gay and Pryke 2002; Kjellberg and Helgesson 2006; MacKenzie, Muniesa, and Siu 2007; Miller 2005). They are a way of referring to the always “material and discursive assemblages that intervene in the construction of markets” (Muniesa, Millo, and Callon 2007:2). They particularly highlight the materiality of economic settings and dispositifs; and they further address the collections and distributions of goods, agencies, and exchanges in so called market encounters, where subjectivities and objectivities are not pre-contained in (what may be taken apart into) separate actors. Far from being external to each other, economic actors in market assemblages come in multiple bundles. They appear as actants (Latour 1996) in the early vocabulary of actor-network theory, not given but heterogeneously produced in practices or *agencements*, so that performances broadly render things, behaviours and processes economic, and being economic notably becomes a path-dependent feature, a story of people and things carried on by events and trajectories, an historical qualification of calculative times and spaces (Muniesa, Millo, and Callon 2007:4).

In the ongoing genres and generative shiftings of the supermarket, calculation does not necessarily mean to establish mathematical operations, but more fundamentally to make a practical distinction between things or states of someone's world, to detach and to reattach them as parts of the different worlds of people and things, and to imagine and estimate “courses of action associated with those things or with those states as well as their consequences” (Callon and Muniesa 2005:1231). This broad definition has the double advantage of eluding a simplification of calculative agents, taken either as subjects making decisions through rational preferences and

competencies, or as subjects that rarely calculate and instead use not-well-defined criteria to make decisions. When calculation is considered instead as a process of attachment and detachment, the people and things taken into account have to be considered, moved, arranged, and labelled to become calculable in a space broadly defined as the “account itself but also, by extension, as the surface on which the entities to calculate are moved (literally or by delegation)” (Callon and Muniesa 2005:1231).

When self-checkouts participate in a market encounter, what renders their calculation meaningful on screen, and helps them to be part of an exchange agreement in a calculative space, can be described as a distributed configuration of calculative agencies, a mundane algorithmic configuration:

They: a) circumscribe the group of calculative agencies that are to be met, by making them identifiable and enumerable; b) organize their encounter, that is, their connection; and c) establish the rules or conventions that set the order in which these connections must be treated and taken into account (formats, queues, etc.). Algorithmic configurations calculate encounters differently, depending on the way in which they perform these operations; each concrete market corresponds to a particular mode of organization (and calculation) of the connection between singular supplies and demands. (Callon and Muniesa 2005:1242).

In this sense, a market becomes not an abstraction from a supermarket but rather an abstraction of the times and the spaces of a supermarket:

Algorithmic configurations are real sociotechnical arrangements. The 'market' does not exist independently of them. Analyses of concrete and abstract markets were dissociated for a

long time, simply because the mechanisms of aggregation and composition of supply and demand, organized within these arrangements, were disregarded and simplified to the extreme (Callon and Muniesa 2005:1242).

As practical abstractions brought into concrete calculative times and spaces, algorithmic configurations are always chronotopical. They are full of genres and generative stories, filled with material-semiotic figures and projects of reconfiguration of people and things. Chronotopes and algorithmic configurations may work together: chronotopes can inform algorithmic configurations by highlighting the histories of different markets devices, and algorithmic configurations can perform chronotopes by associating their concreteness and abstractness. By extension, breaking down chronotopes follows the ethnographic suggestion of paying attention to the details of algorithmic configurations. Chronotopes can help then to grasp the capacities of algorithmic configurations, their circumscription of agencies, organization of agential encounters, and establishment of rules to order and account for agential connections.

Let's move on to break down an interaction with the haptic display of a self checkout machine, and consider chronotopically how actors hang together in each moment of translation of our reading, through four calculable, calculative, and calculated surfaces of the supermarket: the shopping floor, the possible queues around self checkouts, the positions to interface with them, and the passage to take the goods away. Insofar as this list does not reduce the courses of actions with a self checkout to their graphical displays, it remains open for other supermarket stories. The list expands the moments of movement where self checkout machines can be grasped or taken into account.

## **Shopping floor**

If we translate a pragmatic take on calculation to the supermarket, the imagined and estimated courses of action around, through, and away from the graphical interface of self checkout machines, insofar as they inform the boundaries of the shopping floor, are associated with the making of detachable and calculable goods. When entering a supermarket, for instance, I may estimate how many products am I likely to purchase, which informs my preference to collect them with a basket, a shopping cart, or nothing at all; and has consequences on my choice of paying at a cash register, at a self-checkout if available, or not paying at all.

To be collected, goods have to be met as objectified and singularized things. An objectified good means that even something rather abstract may hold together. It may be taken as stabilized, definitive, and definable, grasped through its valued properties for the application and transfer of property rights, and thus made capable of becoming detached from the supermarket shelf. An objectified good is made valuable through the previous design and qualification of the good; but also when the market participants meet for a transaction, and even afterwards if the participants grasp each other's responses and take them into account in a future purchase (Callon and Muniesa 2005:1233). A singularized good means that even something rather abstract may be made capable of becoming reattached to the body of a consumer, who is often prefigured to receive it. This work of adjustment points to a process of co-elaboration of participants in any market exchange (Callon and Muniesa 2005:1234).

The shopping floor can be taken as a spatio-temporal account of what makes collected goods calculable, through their objectification, singularization, and coproduction, insofar as it displays them in conjunction with the material-semiotic surfaces of grocery lists, consumers, hand baskets,

bags, shelves, employees, price tags, infra-red codes, cash registers, self checkout machines, etc. In this sense, to differentiate where goods may be collected in here and carried out there, all these things or entities are associated in ways that bind the shopping floor to translate or better materialize particular employees and customers. In this time and space they can articulate new things or entities. For instance, when a purchase is made a receipt is produced. And then, crucially, any of these things or entities, and particularly goods, might also be detached from one another, to “leave the calculative space and circulate elsewhere in an acceptable way (without taking with [them] the whole calculative apparatus)” (Callon & Muniesa 2005:1231).

The consumer around the shopping floor engages with and is configured in relation to preformatted and precalculated information, supplied mostly by the supermarket (Callon and Muniesa 2005:1238). Moreover, this consumer comes in clusters or bundles, notably through the use of close or remote attachments, facilitated by shopping baskets or mobile phones, which respectively collect people to shop in narrow groups or support purchase decisions at a distance (Cochoy 2008:27). Nevertheless, while the practices of exchange of a market encounter can be aggregated or knitted differently, the supermarket enfolds figures of consumers that invite us to commit to shopping by postponing calculation; in particular, shopping carts or baskets can create a buffer or storage zone which is able to temporarily dissociate choices from payment (Cochoy 2008:20). When the number of items grows in the shopping cart or basket, the commitment to the shopping also increases as it becomes problematic<sup>88</sup> to put items back in the shelves, and so to reverse the direction in which the goods are collected. Hence Franck Cochoy notes, in his detailed study of the shopping cart, that at the end of the journey the consumer's commitment becomes confirmed, with almost all people carrying some goods to purchase (2008:20). This delay in

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<sup>88</sup> It becomes problematic for consumers to return their goods not only because that entails returning to the corresponding shelves, but also because committing to the purchase entails increasing the stack of items, so reaching inside the hand basket or shopping cart and pulling out a collected good becomes tricky; the bigger the pile the harder it gets.

calculation translates budgetary into volumetric constraints. While this effect may be counteracted by making shopping lists, it also indicates how the purchasing and planning capacities of shoppers can “relegate arithmetic preoccupations to a position of secondary importance” (Cochoy 2008:23).

If the calculation of prices may not be what is at stake on the shopping floor, Cochoy proposes that another kind of calculation takes place: qualculation, a practice that is about the evaluation of choices in the absence of calculation.<sup>89</sup> Qualculation breaks down the distinction between pure calculation and judgement, and then fuses qualitative estimation and quantitative calculation. Again (shopping) lists are a good example of qualculation, as they can leave us “utterly perplexed because of their implicit and imprecise character” (Cochoy 2008:26). The shopping list allows an assortment of goods that does not have to follow the coherent logic of organization of the supermarket shelf, so that consumers on the shopping floor may feel “the irresistible gap between the often generic items of the list and the highly diverse supply of the shelves” (Cochoy 1999). I grasp in this moment of shopping a movement, that subtly bridges qualculative distances through estimating the value of the goods, how shopping floors are a chronotopical account of what makes goods calculable. I pay attention here to shoppers making face-to-shelf and face-to basket alignments (figures 40 and 41), noting their commitments to the purchase:

Supermarkets are one of the rare places where people look for 'objects' rather than for 'social' relationships. This bent towards objects is all the more remarkable when the surrounding people are fairly numerous. In supermarkets, observations shows that each 'other' (and his/her shopping cart) is an obstacle on the route between the single consumer and the 'other things' he/she tries to grasp. Human beings and carts screen inter-objectivity:<sup>90</sup> everyone slaloms between carts and bodies that hinder his/her progress; each one waits for

<sup>89</sup> For a discussion of the concept of qualculation and agency see Callon and Law (2005).

<sup>90</sup> See Latour (1996).

the other's move so as to get to the shelves (Cochoy 2008:29).

**Figure 40.** Face to-shelf<sup>91</sup>  
(photograph by author)



**Figure 41.** Face to-basket  
(photograph by author)



Nevertheless, if the shopping floor acts as a screen for people and things to become particular consumers and goods, this surface may work together with the displays of self checkout machines. They may co-produce a perimeter where people may also move sideways from their commitment to the purchase, so their attachments to and detachments from the goods may be reversed. While self service practices are about translating work from employees to consumers, even when payments are delayed or goods are dissociated from points of purchase, people may leave them aside, move sideways out of the supermarket, and avoid an encounter with a cash register or a self checkout. Since the cost of going through the payment of goods can always be reattached to the shopping cart or basket, people in here may indeed stay in touch with their eventual retreat out there, that is, beyond a material-semiotic boundary screened by the purchase,

<sup>91</sup> I thank my dear friends Marina Calota and Liviu Alexandrescu for enacting a self service purchase through the supermarket.

where the wider consequences of carrying goods cannot be conveniently dismissed any longer.

Closing hours, in particular, mark a moment where the shopping floor turns around movement for staff to perform ordering and cleaning tasks, which translates work from the consumers back to the employees. In this sense, nocturnal supermarket activity, according to Cochoy, “performs management not as textbook knowledge, but as situated practice: through its pragmatic garden activity, supermarket staff shows us that market framing is about adopting the consumer's point of view 'physically' rather than 'intellectually': in moving at night into the very space and position consumers will occupy during the day, the supermarket gardeners experience the consumer's own gestures with their senses and bodies” (2007:114). These prolific “gardening” activities react to the fragile things that might break down in the gap between the shelf and the basket, or to the goods that may be abandoned halfway through the purchase – scattered around to avoid their payment, as people can reverse the direction of their attachments to and detachments from the supermarket. In short, both order and mess are generated daily on the shopping floor.

### **Queue line**

Making people and goods present on the shopping floor also entails making manifestly absent the work of other things or entities that may be detached, moved, arranged and ordered around and away from the supermarket. The work of employees in the background of the supermarket, or in the chains of distribution that supply the shopping floor with goods, for instance, may be manifestly absent from the shopping floor. But also the work of other people such as cleaners and accountants, and the powers of nonhuman participants such as electrical systems or water networks, may be disregarded or left out of sight when shopping around the aisles. While encounters with all these labourers may be easily (dis)missed on the shopping floor, queue lines

articulate shoppers in ways that allow us to pay attention to other activities than shopping in a supermarket. Queue lines themselves offer a trace-like figuration of bodies, one that is reminiscent of the worldly webs through which supermarkets are constantly tendered for shoppers, by sorting what is made present, what is kept manifestly absent, and what is Othered from the shopping floor.

Queues of the supermarket are often stretched around the aisles and across their face-to-shelf positions. Such queues break down the space-time of the shopping floor: a particular waiting, queuing to make a purchase isn't about the calculation of prices. And insofar the shoppers also ignore the goods shelved around them, queuing is not about qualculation either. Instead queues resonate more closely with the approximation of distances of people and things – that is with another kind of calculation: calqulation (Cochoy 2008:30). This expression is derived from the French word “calquer” (to trace a model):

In the action of tracing, there is not only the idea of copying, but also that of adjustment. Using tracing paper requires a double aptitude: the purpose is not only to 'trace again' the lines of the original copy, but also to adjust the translucent paper to the model. Let's now imagine that such patterns may be reciprocal, as if two people with their respective tracing papers met on either side of a window pane, the one trying to adjust/trace the drawing of the other, without having anything at the onset and without knowing who holds the original. This hypothetical scene helps us to understand what 'calqulation' is all about (Cochoy 2008:30).

While in the chronotope of the shopping floor people's timing and spacing seem rather independent from one another, in the chronotope of the queue we are more evidently subjected to an adjustment of bodies, a synchroduration really dependant upon the calqulations of one another.

Queuing offers a different moment of movement around the display of the self checkout. When queuing I encounter people and goods differently than when collecting goods. On the shopping floor touch has more to do with detaching goods from shelves and reattaching them to ourselves, but in a queue line bodily encounters mean to stay in touch at a distance. In this zone I move by aligning myself with the spaces between the queuing bodies. People adjust to each other while tracing the queue line. Here I become in touchless touch with other bodies carrying goods and waiting for an available point of purchase. Since my fingeryeyes do not touch the people in the queue line, I hold on to them by grasping that alignment or array that enfolds our neighbouring bodies.

Fraser (2006) reads this chronotope by using Barad's agential realism. For her queues are particular phenomena, a becoming through the intra-action of temporal conditions with specific spatial arrangements. Drawing on the generative spatio-temporality of drug use conjoined or dovetailed with the production of individualized agency, Fraser argues that the methadone dosing point should be understood as showing characteristics found elsewhere in life (2006:194). This insight strikes me as an invitation to compare Fraser's observations with the queues at the purchase points of supermarkets. For instance, both queues entail a site of anxiety, as well as of boredom and frustration, for both methadone clients or supermarket shoppers. And also positions in these queue lines are not easily maintained. The amount of people queuing in dosing points and purchase points is similarly constrained by the number of counters and the concern of institutions with public order and the security of their services.

In this sense, Fraser follows Barad to insist that methadone clients, like supermarket shoppers, are intra-actively co-produced with the queues they inhabit: "clients, themselves already multiply co-constituted phenomena, intra-act with the chronotope of methadone maintenance

treatment (that is, the queue – itself also always already multiply co-constituted). In the process, both the client and the queue impact on each other, reproducing each other differently” (Fraser 2006:199). What matters here is that the queue, as a chronotope of the clinic, acts as much to produce specific subjects as it does to treat them; similarly, the queue of a self checkout, as a chronotope of the supermarket, acts as much to generate particular shoppers as it does to extend a service to them. The shopping floors and the consumers may be tied and untied, or enfolded together, cut together apart (Barad 2007), diffracted through to “become with” each other in self service practices.

While we may confront people's backs in the queue, the face-to-body figures of this alignment can take unpredictable shapes and directions, particularly at peak times, so that (especially express) supermarkets may equip their points of purchase, including self checkout zones, with ordering devices to dictate (regulate, discipline) the embodiment of queue lines. This is a strategy that often builds on how people move sideways from each other in the queue line – in snake-like patterns – in order to bend the alignment. But it is also an ordering that frequently ignores how people might also move away from the queue line, if the time to wait is too long. The calculative apparatus of the supermarket often tries to tame and direct the queue by adding stripes and stands or marks on the floor. In the absence of these device, to navigate the obstacles around the purchase points people bend their bodies to curve the queue line and so to literally go around their troubles. Ordered and messy trace-like patterns are plots of calculative alignments.

The queue offers a moment of movement sideways from the aisles and the shelves, not following a passage that reverses the directionality of the attachments and detachments of people and goods, but an alignment that directs them toward a purchase point. Attending here to the histories of self service practices may materialize consumer subjects that, following Barad's

phenomena, can intra-act with the queue line to respond differently, and so interfere with their supermarket stories, while waiting to move collectively. Queues at the self-checkout machines situate bodies in a trace-like patterning of people and things. Queues remind us of how we are always a part of a specific time and space, joined in ways that are irreducible to consumption patterns on the shopping floor of a supermarket. Queues materialise particular subjects: here we may become different people than the consumer, configured for us on the shopping floor, if we inhabit queues as intimate places, spending time to attend to our overlaps with other people and things.

### **Purchase point**

The chronotope of a supermarket purchase offers a third moment of movement around, through, and away from the haptic display of a self checkout. When approaching an available machine, this space of interaction breaks down the space-time of the shopping floor – or alternatively the queue line. Since here purchases are algorithmically articulated through the graphical interface of self checkout machines, I encounter goods differently than when my body was collecting them. As Callon and Muniesa propose, “the purchase is not the result of a subject-object encounter, both external to each other, but a process of attachment” (2005:1234). The purchase wraps up the ways through which calculable goods are objectified, singularized, and coproduced; it bundles how they become attached to specific consumers. Most importantly, it designates as well an exit passage for the consumer to detach herself and the collected goods from the supermarket.

**Figure 42.** Shifting goods around the interface  
(photograph by author)



**Figure 43.** Accessing the payment slots  
(photograph by author)



Self checkouts are frequently mounted in enclosed containers whose content can be seen only when employees handle the storage of money, or provide service to their electro-mechanical circuits. I try to watch without drawing attention to myself, after making a purchase, how three employees now expose the inside of a self checkout. One of them is retrieving small boxes with cash inside, while the others stand around the opened machine. It seems as if they attempt to conceal the perimeter of the self checkout, left vulnerable by the task of opening it. When employees interact in this way with these machines, consumers are not allowed to use them. Disclosing the concealment of the self checkout excludes it from bounding the shopping floor, which in turn breaks down the consumer's exit passage. Still, insofar as the display of a self checkout, already designed to work on the shopping floor, hangs together in practice with users, currencies, and things, it bounds their transactions within the supermarket and proliferates a variegated production of goods and attachments by profiling customers. This machinic moment

particularly entails moving things around the interface, while keeping myself aligned with the touchscreen, and then moving away from the supermarket rather than around the shopping floor. This self service purchase uses my eager fingereyes to shift goods in order from one side of the interface to the other (figure 42), it lures me to swap money between the outsides and the insides of my wallet and the payment slots (figure 43), it designates with a receipt my ownership over the collected goods (figure 44), and it allows to move beyond the shopping floor of the supermarket (figure 45).

**Figure 44.** Producing a receipt  
(photograph by author)



**Figure 45.** Moving beyond the shopping floor  
(photograph by author)



To touch a screen here means to be touched back, a transfiguration of ourselves in touch with others. I grasp this self checkout zone in my own body-work (Myers 2008) of translating things and money, in response to the specific modalities of a purchase rendered calculative through reciprocal touch. In turn, the sensuous proximity with this machine allows me to grasp quite

literally the perimeter between the chronotopes that collect the goods in here and then carry them out there. In the supermarket purchase, I feel how this kinetic encounter is a dance where subjects and objects may exchange positions. People may be materialised as users/consumers, as objects of economic design; and self checkouts may be personified as cashiers/employees, as subjects of a market exchange. In this entangled way, the purchase configured into the self checkout orchestrates an algorithmic moment of movement that breaks down with the qualculative and calqulative times and spaces of the shopping floor and the queue line.

Research in this site can take Callon and Muniesa's algorithmic configurations quite literally, simultaneously marked by the capacities of the machine and the gestures of a “user” aligned in step-by-step procedures for calculations. Algorithms of self checkouts indeed can be followed to effectively enact a purchase, yet this is far from consistently the case. This is because, as I emphasized earlier, translating work from employees to customers by means of a self service machine encounters resistance from shoppers as well as conditions that computers need to meet. According to Frank Levy and Richard J. Murnane in 'Dancing with Robots' (2013), a computer may replace a human in a task only when two conditions are thoroughly satisfied: first “an information condition: all information necessary to carry out the task can be identified and acquired in a form that computers can process”; and second, “a processing condition: the information processing itself can be expressed in rules” (7). While rules might be programmed for self checkouts to enact a purchase, for them to gather all of the information necessary to perform this task effectively becomes tricky, and prone to breakdown.

As one example, the Wall Street Journal (2013) highlights, after interviewing several former employees, a particularly demanding issue for checkout workers: identifying fruits and vegetables. Since these delicious items may be sold by units and without price tags, checkout workers need to

identify them with their own fingeryeyes and without infrared scanners. Some workers say it takes up to a few weeks or months to memorize the correct codes, while others continue double checking with a book of codes. In any case, the article claims that self checkout machines, in contrast to human cashiers, cannot tell “shiitakes from Shinola. Instead of identifying your produce, the machine asks you, the customer, to type in a code for every leafy green in your cart. Many times you'll have to look up the code in an on-screen directory. If a human checker asked you to remind him what that bunch of the oblong yellow fruit in your basket was, you would ask to see his boss” (Wall Street Journal 2013). Self checkout machines cannot easily differentiate “shiitakes from Shinola” because their own fingeryeyes – their haptic displays, their sensor pressure surfaces, and their infrared scanners – are tied to messy practices that neither qualculate or calqulate, but calculate market encounters with algorithms that divide the labour of screening a purchase, and further distribute such task collaboratively between the user and the machine. To quote Melville's Moby Dick, “it is a mutual, joint-stock world, in all meridians” (1922:63).

Note that sometimes it is the self checkout machine that does the screening for a consumer; sometimes is the consumer who performs the screening for a self checkout. Alternatively, sometimes it is an employee who becomes the “user” doing the screening for the consumer and the machine; sometimes the customer explicitly needs help from the employee (for instance when a purchase needs approval or when the machines run into network connectivity issues, and employees can further help with an unscannable item or by removing unused baskets). And sometimes it is the customer who remedies a breakdown by herself (for instance when a self checkout warns of an unexpected item in the bagging area, I may reverse the action by removing whatever is bothering the machine from the pressure sensor surface. This does the trick most times). After checking out my groceries for a while in this way, I have actually learnt to dance decently with the checkout machine. Just like the workers from the Wall Street Journal article – who eventually learned to

identify and then memorized the codes of fruits and vegetables – I have learnt to identify a few of the rules of the action encoded into self checkouts, and I have memorized them through my own body-work of going through the purchase – that is, by moving goods around the machine while staying aligned with the touchscreen. Nevertheless, sometimes breakdowns become rather irreversible situations – if items are too heavy so that they break down the pressure sensor surface, or if the customer has no cash or coupons, or the purchase won't go through the secure network.

Even when the information condition of a purchase is translated more or less successfully both by the user and the machine, the processing requirements expressed in the algorithmic engagement can exasperate the shoppers. Self checkout machines may invite you to put your own bags in the bagging area, but for some reason the pressure sensor surfaces, all designed for the computer to gather information to perform this specific step in the purchase, often fails to sense them. So for the machine to meet such practical requirements, I would then remove the bags and wait a few seconds to try again, which often works. Nevertheless, allocating goods to the pressure sensor surfaces I still experience issues that test my own patience as well as the performance of the algorithms configuring the purchase. In particular, when the machine gets locked down in the “unexpected item in the bagging area” message, I cannot escape from the situation by myself. If there is no available employee nearby to assist me, then I must move sideways from the machine: abandon the breakdown but not the self checkout zone, to look for another available self service point of purchase. Or alternatively, not without frustration, I might turn around to go back to the queue line, and contemplate using a staffed cashier. Filling up the breakdowns of this chronotope conjoins the shopper and the employee in an ontological dance (figure 46) on the shopping floor with the machine, which displays for each person a specific access (figure 47) that limits their algorithmic configuration.

**Figure 46.** The self checkout  
dancing floor  
(photograph by author)



**Figure 47.** Employee security  
access card  
(photograph by author)



When the purchase is ready to be closed by the payment, the dance of customers, employees, and machines is taken – in at least in two directions – beyond the self checkout zone. First, making a payment entails that the shopper moves on from her face-to-sensor and face-to-scanner positions to her face-to-slot configuration, in order to access the available entrances and withdrawals for currencies to pay. The self service payment situates consumers in front of the touchscreen in the centre, to bound the moments of movement around the aisles and purchase points, so that when consumers pay they face an alignment at the boundary of the shopping floor, a point where they stop looping through the collection of goods and are directed out of the supermarket.

Surely consumers aiming to dance decently with a self checkout are responsible for their payments, but once the purchase goes through they also become attached to the wider consequences of those payments: to what they buy into when they go through shopping floors configured to profit

from their actions. Moreover, the payment produces information about the purchase, luring the user to disclose not only her wallet but also her identity, and through the use of credit, debit, and loyalty cards, the payment reaches into different circuits of currencies that may attach profiles to purchased goods. This extension of the calculative apparatus stretches into the “back office” of the machine, which manifests the absence of certain parts of its configuration at work in the self checkout zone. In other words, to subtly catch what allows consumers to calculate with self checkouts requires me to extend my fingereyes into the storage, maintenance, concealment, and policing of money data, to reach something that is manifestly absent in the presence of the purchase, just because consumers are not supposed to deal with this part of a supermarket's algorithmic configuration. After touching the haptic display, I look for wired or wireless connections that extend the machine as a part of centralized lines of database storage.

While focusing the attention of the user on the screen, money machines like self checkouts tend to conceal the material-semiotic threads, the hardware and software, allowing them to work together in zones designed to make data flow (MacKenzie 2002) through architectures for things always in-formation. Let me offer one alternative to this mundane problem, by turning my fingereyes to the pages of the manual and overview of another self checkout machine, the IBM Self Checkout System 4845. This text<sup>92</sup> details how that machine is made of a cash module, a security module, conveyors, and bagging areas. Among the security options of this self checkout machine one may find authorization software, bar code scanner scales, security curtains that measure item dimensions, and bagging area scales that verify scanned items when they are packaged. The text discloses the back office as well (figure 48), that is, the point of server controllers (POS), the network server, a networking device (a hub/switch), and the back office system server (BOSS).

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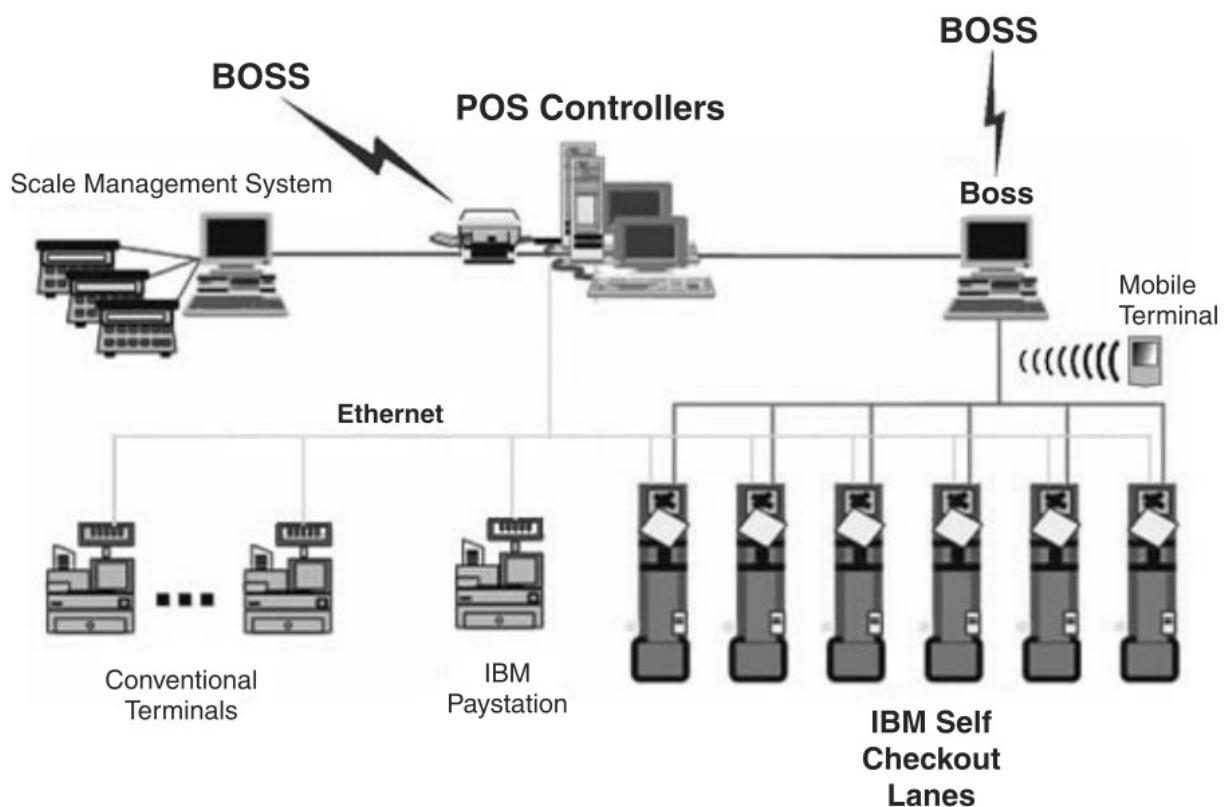
<sup>92</sup> [http://tvintec.com.vn/upload/file/products/ibm-self-checkout-systems\\_592.pdf](http://tvintec.com.vn/upload/file/products/ibm-self-checkout-systems_592.pdf) (last accessed 17/06/2016). The self checkouts I engaged with during my ethnography were made by NCR, but I could not find data of the assembly of their machines.

It is this security module that highlights, most prominently, how the purchase directs consumers into a passage where their attachment to goods becomes rather irreversible. Note how even when the consumer may bypass the security options and, with the help of the employee, still reverse the course of action of the purchase in the last minute – for instance, by unscanning and returning an item – as soon as the purchase is wrapped up by the payment with a debit, credit, or loyalty card, reversing or erasing the data collected by the back office of a self checkout becomes much harder than reversing or refunding the payment of the purchase. It seems this is the case because the business of the back office of the self checkout entails collecting information to profit from consumers by turning them into well known customers, that is, into subjects from whom someone (who?) may learn to identify and so extract more value on each purchase.

**Figure 48.** IBM Self Checkout

System 4845 back office

(IBM Self Checkout System 4845 overview)



To think more generally about how to make present the consequences of the manifest absence of calculative agencies, such as the algorithms of the back office of self checkouts, I will discuss in the conclusion of this chapter how I think people in calculated market exchanges may aptly respond to this line in the centre – an ordering line that became present when I confronted the display of the self checkout in wrapping up my purchase, but also when I faced the ordering of the parallel aisles to collect goods, and the straight ordering of the parallel lines to queue for a purchase point. This line in the centre of the supermarket may be grasped as well in the straight ordering of the parallel doors and walls, through which consumers pass when they leave the shopping floor.

### **Shopper's exit passage**

Let's sum up the three previous moments of movement bounded by the purchase, which designates an exit passage for the consumer. First, on the shopping floor the action of calculating the value of goods is delayed by the production of a buffer zone: a specific space where goods may be detached from the shelves and attached to the consumer; and a specific time meant for consumers to make a commitment to the purchase. I unpacked on the shopping floor how making goods calculable is about the embodiment of qualculations, that is, about the estimation of the values of the goods in the absence of calculation. To shop on those particular floors, people need to thread a knot between their face-to-shelf and face-to-basket positions without losing their grasp of the relation between the highly diverse supply of goods from the shelves and their desire for things. Lists sometimes help in sorting out the gap. However, calculations can still take a place on the shopping floor, which entails the chance of reversing the direction of the action of collecting goods, largely without consequences for the consumer. Goods can be taken out from their hand baskets or shopping carts, and dispersed across the shopping floor. And in this sense the closing hours of supermarkets allow employees to reorganize the shopping floor more discreetly. Such gardening

activities may be observed at times by the shoppers during opening hours as well.

Second, when consumers move away from the shopping floor; that is, towards an exit passage through which they can detach themselves and their goods from a supermarket, they can bump into a queue aligned to a purchase point, which can be placed in a self checkout zone or equipped with a staffed cashier. In a queue line the action of calculating goods is delayed by the production of a second buffer zone: a specific space where consumers may be detached from the aisles and attached to other consumers; and a specific time meant for consumers to pattern themselves with other bodies, to the point that queue lines always truncate the individual “selves” of self services by forcing people to act with others. I unpacked in the queue line how making calculative agencies is about the embodiment of calqulations, that is, about the tracing of the boundaries of actors in the presence of their (intra-)actions. To queue in those particular floors people need to thread a cut between their face-to-other body positions, without losing their grasp of the alignment. Qualculations might also happen in the queue if shoppers, instead of assuming face-to-body positions, adopt face-to-basket positions in order to gaze at each other's items.

Third, in the machinic purchase the action of calculating goods is made possible by the reduction of the buffers zones that delayed the purchase. This is a specific space where shoppers detach themselves from the aisles and attach themselves and the goods to a self checkout; and a specific time meant for consumers to wrap up the purchase, and then to leave through an exit passage. I unpacked in the machinic purchase how making calculated exchanges is about the embodiment of algorithms, that is, about the step-by-step dancing of the procedures for calculations in the presence of calculable goods and calculative agencies. To purchase in those particular zones, people need to thread and cut the knots between their face-to-scanner, face-to-sensor, and face-to-slot positions without loosing grasp of the touchscreen in the centre and the goods on the sides.

Employees sometimes help in sorting out the purchase. Calculations happen algorithmically every day in the self checkout zone, which entails that the direction of the action of purchasing becomes rather irreversible. After a purchase people may want to return their goods, which they can accomplish with the help of employees, but in the case of a satisfying exchange overall there is nothing left to calculate. Through the machinic purchase, shoppers and goods become entangled with the self checkout's back offices, where shoppers may become well known customers.

Thinking about the shopping floor, the queue line, and the machinic purchase in terms of qualculation, calqulation, and calculation, as different practical algorithmic configurations, already allows us to grasp two features of the shopper's exit passage. First, the direction of the action of the purchase through the shopping floor and the self checkout zone changes, from being more to less reversible to becoming rather irreversible in the exit passage. Second, within the shopping floor, the queue line, or the machinic purchase, shoppers can pay attention to how people and things are made present and manifestly absent for them in the supermarket. And they can grasp too how the people and things that are made manifestly absent might suddenly become present and vice-versa. Nevertheless, I sense as a consumer in the supermarket that it is quite a different question for me to grasp what is Othered: what remains further concealed and so never present or manifestly absent, on the shopping floor or in its background.

In other words, and because the exit passage I must go through to move away from the shopping floor with my goods is one of the many ways of detaching people and things from the supermarket, this chronotope often entails to other or to divide and conceal from me the exit passages of some people and things of the supermarket. However, one may think that the exit passage is where all people and things, living or not, always turn to when any other chronotope breaks down. This passage, bounded by several doors and walls, leads outside the supermarket.

After collecting my items, I begin to walk through a path that collects people moving away with their goods from the supermarket, which dovetails the shopping floor inside and the public street outside. I approached my exit, passing through the main doors (figure 49) of the shopping floor and through the main gate (figure 50) enclosing the parking space, still signalling the insides and outsides of the supermarket. In this chronotope, people and things eventually break away. Exit passages make a space that keeps consumers moving towards the outside, but also provides them with a time to think about what may have been left unnoticed inside. As shoppers, I think the reminder matters not only if one forgot something at the self checkout, but also because this can be a time to grasp what takes place and for whom in a supermarket.

**Figure 49.** Main door  
(photograph by author)



**Figure 50.** Main gate  
(photograph by author)



## The supermarket as device

The specific algorithmic configurations that inform self checkouts entail an embodiment around, through, and away from their graphical displays, an exchange that signals a rather practical agreement between the supply and demand of the supermarket. I traced this as a course of calculative trials, moments of movement where goods became knotted to shoppers in ways that directed them through the calculative apparatus of the supermarket. This agential compromise settles trials of calculative strength, as according to Callon and Muniesa market encounters produce a “compromise not on values but on the instruments that calculate values” (2005:1239). In this sense, while grasping qualculations, calqlulations, and calculations, we have explored just a few of the market devices, including the self checkout machine, that help us consumers to reach a calculative compromise with what is made present and what is made manifestly absent in encounters with supermarkets. I considered as well the exit passage, a chronotope to highlight a specific moment of movement where there is apparently nothing left to calculate, so that I could offer a space and a time for curious consumers to think about what is Offered for them through this passage.

In the exit passage, I may recall how algorithmic configurations gather agencies with asymmetrical calculative powers:

from the design down to the display of products on shelves, series of professionals are involved, all exploring the consumer's distributed world the better to integrate the product into it by playing skilfully on the product's qualifications. Facing the consumer are a multitude of professionals armed with computers, studying his or her movements and calculating margins down to the last cent or gram (Callon and Muniesa 2005: 1238).

Thus asymmetrical calculative powers are at work on the shopping floor, where there are trials to calculate which aisles should consumers go through, which goods they should desire, and how they should collect them. In the queue line, where there are trials to calculate the movement between the queueing bodies, what distance should we leave for people to go through. In the machinic purchase, where there are trials to calculate which goods should consumers buy, how much money should they spend, and which payment method should they select. In all these trials of calculative strength consumers meet a line in the centre of the supermarket; that is, an ordering line spread in the parallel layout of the shopping floor, in the alignments of queues shaped by stands and stripes, in the purchase where consumers confront the touchscreen to display goods and to pay for them, and in the customer's exit passage where consumers detach themselves and their goods from the shopping floor by going through the line that bounds the supermarket's insides from the public space beyond. Most importantly, consumers deal with the line in the centre of the supermarket as a matter of asymmetrical calculative powers. Facing a line in the centre matters because it signals the calculative strength of the apparatus of the supermarket, particularly when a choice is made available for consumers to shop around the aisles, when an alignment is made available for consumers to wait around the purchase points, when a zone is made available for consumers to check out goods through a machine, and when it seems there is nothing left to calculate within a passage made available for consumers to leave through the supermarket's doors and walls.

While purchases settle market encounters, it is not always the case that consumers must remain weak in relation to the power of supply, and the desire for profit, configured in the supermarket. On the one hand, avoiding impulsive buying, or spending time comparing prices, are already robust strategies to respond to the algorithmic configurations of the shopping floor. The same becomes valid for the queue line, where people can help each other to signal the alignment more evidently, where it begins or where it leads, without need of calculative props like stands and

stripes. In the case of self checkouts, it is still possible for consumers to remain anonymous, if we avoid profile and subjection to unwanted customer services by paying with cash instead of credit, debit, or loyalty cards. On the other hand, calculative powers indeed have their limits,<sup>93</sup> so it would be rare to find a specific customer with the capacity to open a supermarket just for herself, on a Sunday night, if she forgot to buy milk and cookies. The same goes for finding a customer with the capacity to decide the shape and rhythm of a very long queue in an overcrowded shopping floor, or with the power to modify the prices and payment options of self checkouts.

Let me conclude by underlining how the shopping floor bounded by the purchase may be articulated differently, and so what counts as a supermarket may be reconfigured as well by mounting its insides and outsides beyond the immutable immobile doors and walls that often conceal it. Again the Woolworths museum's website offers a telling example of this possibility, a mobile shop:<sup>94</sup>

One of the more bizarre episodes of Woolworths' history was the 1957 launch of a mobile shop [figure 51], which was intended to be the first of a fleet. A single decker 'Green' bus was purchased from the London Country Bus Company and converted into a small self-service shop. It was filled with a selection of household items and toiletries. A "Manager/Driver" was appointed along with two Sales Assistants [...] While it was warmly received by some shoppers, local traders hated it, particularly in established towns which didn't have a Woolworths store. They lobbied local councillors to ban the mobile shop,

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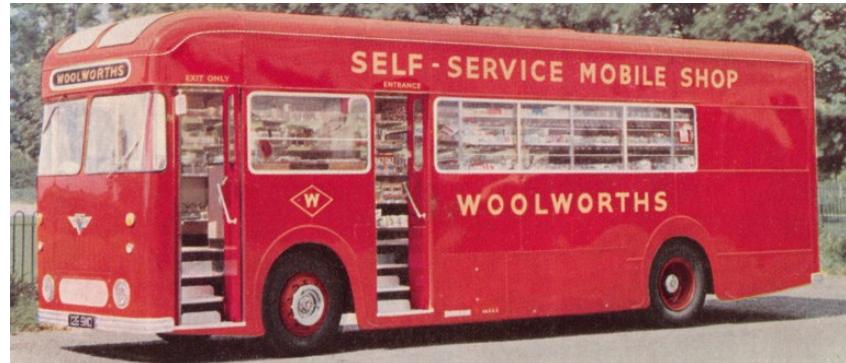
<sup>93</sup> Which is the case for self checkouts as well, not only because it is practically hard to gather all the necessary information for them to perform their part of the purchase, but also since the algorithmic rules that inform the process must be expressed, for instance, in a polynomial rather than exponential time. Otherwise the user risks getting stuck with the machine in algorithmic time (the halting problem) and other computational troubles. This suggests that people meet in the machinic purchase two ways of thinking about complexities. One coming from complex system theory as a general characterization of a whole with many parts that interact with each other; another one coming from computational complexity theory as an axiomatic take on the resources needed for executing algorithms.

<sup>94</sup> <http://www.woolworthsmuseum.co.uk/50s-mobileshop.htm> (last accessed 17/06/2016)

pointing out that it did not pay rent and rates or employ local people. They said that the lower running costs gave the chain an unfair advantage (Woolworths Website).

Even as the 'Woolworths on Wheels' (WoW) was a "political minefield" according to the museum's website, this experiment effectively "embraced the principles" of the purchase as a self service practice, reconfiguring the moments of movement of such an experience, the shopping floors, the queue lines, the machinic purchase, and the exit passage, to fit into a bus (figure 52). This is a concrete though bizarre situation where the supermarket can be abstracted into and mobilized to different places, one that helps me to suggest that the chronotopes unpacked on the shopping floor, in the queue line, the machinic purchase, and the exit passage, may be reassembled together differently insofar as the supermarket is calculated and screened not only through, but also around and away from the purchase point. Such configuration dovetails the moments of movement of the purchase into each other. There they remain mutually performative and reciprocally differential, only if consumers collect goods around the aisles and queue around the purchase point, and thus exit the shopping floor by moving away from these specific surface circuits of the supermarket.

**Figure 51.** WoW – outside  
(woolworthsmuseum.co.uk)



**Figure 52.** WoW – inside  
(woolworthsmuseum.co.uk)



On the other hand, there are configurations of the supermarket where the moments of movement may be reassembled together differently by computing and screening them only through the purchase point; that is, when consumers don't have to collect goods and queue around the shopping floor, but through market devices such as mobile phones loading the websites of supermarket stores. There the shopping floor becomes a site online, the queue line becomes a delivery list, the machinic purchase computes and screens the insides and the outsides of the supermarket all through the graphical interface, and the exit passage becomes a delivery route that employees with their trucks, instead of anonymous consumers with their bags, have to go through by stretching out to reach well known customers. There consumers exit the shopping floor by identifying themselves in the purchase and checking out goods specifically through the surface circuits of such online supermarkets. This is a concrete though less bizarre situation where the supermarket can be abstracted into and mobilized to different places, but one where the consequences of the moments of movement bounded by the purchase remains to be grasped in detail.

## **Chapter 7. Spacing the ATM**

Extending the investigation of the temporalities of screening through self checkouts in chapter 6, this chapter expands on the spatialites of the courses of action bounded by a computer screen when passing through automated tellers. My sense of the expression ‘passing through’ is borrowed from the pukara, a toponym for fortress-like places surrounded by walls, to stress the troubles of becoming in touch with the people and things enfolded into accounts. Passing through automated tellers underlines how people and things do not simply assemble a course of action with an apparatus in a place, but rather participate in the assembly (or co-production) of action, apparatus, and place. Staying with that trouble requires people to knot accounts by staying with a course of action, attaching and detaching themselves by stretching and cutting their ways, through the different bounded places around, through, and away from the ATM apparatus.

In the previous chapter I used khipus to reimagine how to stay in touch with accounts of the supermarket, to pay attention to the times enfolded into the knots used to calculate. Here I reimagine, with the walls of pukaras, how to subvert these knot figures, as they are enfolded into accounts of the bank. Pukaras bound people inhabiting particular lives that include knotting practices in order to make those lives accountable. The pukara of Chena in Chile, for example, was an astronomical observatory. Stretching and cutting a course of action are gestures that I grasp with pukaras as figures that deal with multiple bundles of pleats or folds: figures attuned to the material durability of envelopings (Deleuze & Strauss 2006:242-247). As bundles of folds, the walls that bound pukaras offer a resistance to anyone passing through. These folds are parts of an apparatus stabilizing the slippery and fragile distinction of living inside or outside of this *topos* (figure 53). Likewise, passages can be stretched for smooth movement between these insides and outsides

(figure 54). But passages of access may be cut as well: “Others” can break down the folds and take over the stronghold. Such confrontations may lead to the fortification of pukaras with an apparatus that exhibits, in the features of its walls and passages, the capacity to signal what may be out of bounds. So this apparatus configures a line in the centre to screen the lives enfolded into the fortress.

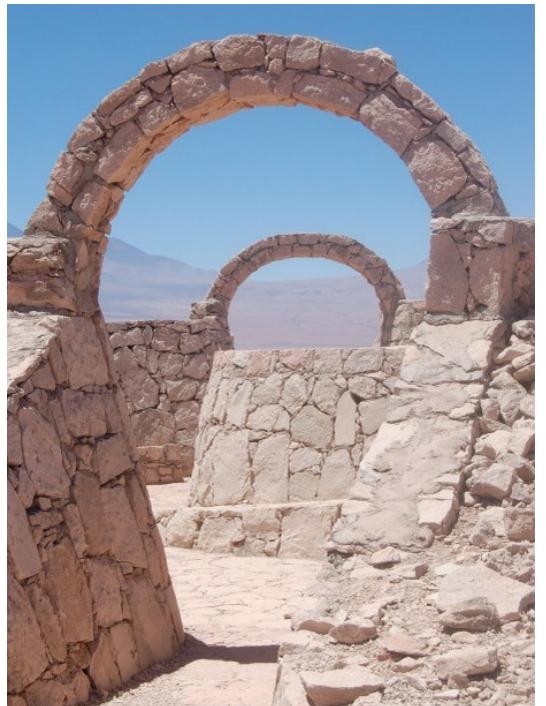
**Figure 53.** Inside a pukara<sup>95</sup>

Pukara of Quitor  
(photograph by author)



**Figure 54.** Passage of access<sup>96</sup>

Pukara of Quitor  
(photograph by author)



With pukaras I explore the subversion of a fortification of knots by way of creation; in this case, by refiguring money to suggest a resistance to the line in the centre. To withdraw cash with automated tellers is clearly a course of action that lures people to disclose themselves at a cash point. However, withdrawing cash with the machine is also a practice secured only partially by the

<sup>95</sup> One of the various online sources for this image is <http://goo.gl/tu16yN>

<sup>96</sup> I borrow this image from Jen Pappas' blog: <http://notavacation.wordpress.com/tag/pukara-de-quitor/>

various locations of a bank. Thus, a list of moments of movement around, through, and away from automated tellers can begin in public places for private use (like a street), as well as in private places for public use (like a supermarket), where the protections for these machines may be assembled.

These strongholds are never given, but rather are produced relationally or composed in practice, through the generative meetings of people with machines designed for self service banking, and with landscapes whose material and semiotic points of spatial reference (lines, surfaces, volumes) make it possible to mix a strongroom with an extension of the counter of a bank. As a meshing of two banking devices, the counter and the strongroom, the automated teller may be materialized with a line in the centre that persuades users to disclose themselves: to identify themselves as individual clients whose profiles are aggregated by banks to make a profit.

I sketch a method with figures aimed at messing with this practice. By moving sideways<sup>97</sup> at a cash point, I think people that can respond to the automated teller's line in the centre with gestures that subvert its mode of addressing clients 'with a personal touch'. Moving sideways is a positioning during the course of action with one another body. In this chapter I outline how moving sideways at the cash point may leave users undisclosed, opening up places for currencies to circulate outside of the daily financial circuits of banks, detached from the line in the centre of automated tellers.

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<sup>97</sup> On moving sideways, see chapter 1.

## Cashing in

On Penny street, I reached into the pockets of my blue jeans and pulled out my brown wallet. An instant ago in the town of Lancaster, while walking down the damp pavement, I searched for my debit card, found it in between some old bus tickets, and raised my head to scout for an automatic teller machine. There is a market down this street, where local products are sold two times per week, by people who are now busy weighing fresh veggies, preparing take away meals, sorting out books, magazines, records. The preferred method of payment here is cash, which I need to withdraw from a cash point nearby. There are several alternatives: I could try the bank to make a withdrawal, or get cash back from an express supermarket. But now using an automated teller seems to me more practical and a bit quicker. Nevertheless, unlike the self checkout tellers of the supermarkets, these machines articulate banking services in a multitude of places which can be modified daily. Thus here, within this mutable market in the town centre of Lancaster, a layer of industrious people troubles my grasp of an automatic teller capable of extracting my account details from a card, given to me by a bank. Reading the card's brown strip will not be possible, it has been wiped out from use and most machines will now refuse to authenticate my cash withdrawals. But I suspect some helpful automated tellers are still able to process my requests by reading my card's silver chip. I look around. My attention jumps between the old buildings and the market – while this public place called Penny Street, the usual shapes, sizes, and locations as I remember them, appear suddenly blurred out.

I feel lost in translation. I try to reimagine this place without the street market networked on top of its otherwise rather immobile geometry. Eventually I manage to spot the automatic teller, sticking through a rectangular hole in a wall, blipping next to a white tent assembled this morning as a part of the street market, which leaves hardly any space to queue behind the cash point. I

approach the place sideways, moving parallel to the wall, to queue by drawing an L shaped figure in between my body and the cash point. Someone is using the automated teller. While waiting I watch her making a cash withdrawal. I lean over to see her introducing her plastic card through an access-slot. In turn the machine asks her for her PIN number. She covers the keyboard with her left hand while typing it. After that someone else approaches the queue.

The menu patterns here can vary widely among automated tellers, but in all cases the algorithms coded into the machines equip users with particular ways of passing through the self service cash point. For instance, note that some machines return the user's card before the withdrawal of cash, while others do exactly the opposite. Likewise, this machine now in use dispenses one specific currency (£ or UK pounds). It makes a grinding noise too, if you listen closely, when sorting out the cash withdrawal. Most automated tellers can create a log of their activities, and may print a receipt on demand. Wrapping up the withdrawal, a beeping sound reminds the user to collect her cash and card. Detaching her fingereyes from the graphical interface, she moves away by walking through an exit passage, parallel to the wall and the white tent.

So far we may notice that there is a multitude of places, and a variety of ways, in which automated tellers articulate a course of action – in order to pass by a cash point. Let's begin to unpack these multiplicities, by addressing this literal “hole in the wall” now in front of me. Touching the rectangular cuts on the rough wall, the hole reminds me of how banks initially accepted the use of automated tellers, to expand office hours and to multiply the points of distribution of cash. In 1930, Luther Simjian began experimenting with this idea, eventually patenting a prototype called the Bankograph. Still it was much later, in 1961, when the Bank of New York decided to install the machine in the city of New York, to work primarily as a safety

deposit box. The Bankograph was an automated teller without any dispensing features, it only accepted envelopes with coins, cash or cheques. Importantly, for bank customers to trust the automated teller with money was an issue from the beginning. In the case of the Bankograph, sceptical customers were assured they would see their money again, by taking a picture of the deposit. Hence the name Bankograph. This photograph-proof was taken by a microfilm camera inside the automated teller, but this banking experiment did not catch on. Simjian much later explained that the only people using his machines were “prostitutes and gamblers” (History.com Staff 2010).<sup>98</sup>

While the Bankograph did not attract enough clients to make a worthwhile investment, during the same decade more prominent stories of automated tellers emerged, with devices that would dispense cash for a user now with a card. By replacing candy with cash, in 1965 John Shepherd-Barron conceived an automatic teller machine much like a kind of chocolate dispenser, after being late on a Saturday morning for his usual visit to the bank to withdraw cash. Shepherd-Barron's conceptual design of a self service machine proposed to disentangle the distribution of cash from the opening and closing hours of the bank. Desiring and trusting the money in the machine was a precondition for the concept to succeed. The machine did catch on this time. In 1967, Shepherd-Barron and his printing firm De La Rue convinced Barclays Bank to host the new self service machine, the automated teller, in Enfield High Street, North London, the first of six prototypes to be installed in the United Kingdom. The machines invited users to introduce a four digit PIN number, but unlike today's automated tellers, they used paper vouchers imbued for security reasons with a slightly radioactive isotope – carbon 14.<sup>99</sup> In turn this token was used to dispense £10 notes – one at a time. The radioactive paper vouchers were then retained by the

<sup>98</sup> <http://www.history.com/topics/inventions/automated-teller-machines> (last accessed 17/06/2016)

<sup>99</sup> The coding on a magnetic strip of the user's bank account details was coined by a start-up called Speytec in 1969, marketed by a company name Burroughs, and hosted by the Midland Bank (Wikipedia's ATM entry retrieved from [http://en.wikipedia.org/wiki/Automated\\_teller\\_machine](http://en.wikipedia.org/wiki/Automated_teller_machine) last accessed 26/06/2016).

machine and sent back by post.

These machines did not yet constitute a new financial network, of their own kind. They were not connected to one another. Likewise, other contemporary tellers to the Bankograph – such as the Bankomat hosted by Nixdorf or the automated tellers hosted by the Westminster bank and built by the engineering and locking companies Smith and Chubb – used punched rather than radioactive cards, but still remained disconnected from each other's self banking services.<sup>100</sup> Eventually, these ATM companies would not catch up with further developments in technical infrastructures for forthcoming automatic teller machines: “IBM engineers worked to develop the rails, pipes and standards on which other elements of the payments ecosystem – such as credit cards and point-of-sale terminals – would eventually depend. By the early 1980s, however, ATM manufacturers such as Chubb, De La Rue and Docutel had failed to keep up with further developments in computing and electronics” (Bloomberg 2013).<sup>101</sup> Building networks for these machinic self banking services was an assembly task taken up internationally, “independently though simultaneously in the United Kingdom, the United States, Japan, and Sweden” (Wikipedia's ATM entry).<sup>102</sup>

A telling case of how the capacities of automatic tellers proved of value comes with a blizzard that hit New York City in 1977 – an event that paid off the risky investment of Citibank, that year spending over \$100 million (US dollars) to install automated tellers all over the city. Banks were closed for days and “ATM use increased by 20 percent. Within days, Citibank had launched its by now familiar 'The Citi Never Sleeps' ad campaign [...] posters and billboards showed customers trudging through snow to get to Citibank ATMs.” (History.com Staff 2010). In the 1980s, NCR Corp. and Diebold Inc., two companies from Ohio, US, would effectively take over

<sup>100</sup> The conception of the networked automated teller is controversially credited to Donald Wetzel and his company Docutel of Dallas, US.

<sup>101</sup> <http://www.bloomberg.com/view/articles/2013-03-27/how-the-atm-revolutionized-the-banking-business> (last accessed 17/06/2016)

<sup>102</sup> Retrieved from [http://en.wikipedia.org/wiki/Automated\\_teller\\_machine](http://en.wikipedia.org/wiki/Automated_teller_machine) (last accessed 26/06/2016)

the supply of ATMs for the next two decades. These companies capitalized on “deregulation and the banking industry’s growth across retail markets” (Bloomberg 2013) while introducing features like multi-functionality (money transfer and balance enquiries) and the horizontal dispensing of cash, a feature that helps to reduce jams while dispensing bills. Bernardo Batiz-Lazo notes that automated tellers soon freed banking staff to perform more ‘high-value’ services than dispensing cash, such as insurance, mortgages and stock-market trading, explaining that the machines then “became the backbone of the payments system, and opened the door to telephone and Internet banking” (Bloomberg 2013). Microsoft Corp. around that time began expanding their operating systems into personal computers, but also into automated tellers, while Triton Systems Inc. and Tidel Engineering LP created cheaper machines that used dial-up rather than dedicated phone lines, and so opened the door for other companies to install independent machines, dispensing cash for a small fee in grocery stores, bars, casinos, etc. All secured a piece of the business and contributed to the rise of the mundane becoming of the automated teller as a terminal of a “bank’s central computers, enabling online verification at the point of transaction” (Bloomberg 2013).

A recent benchmarking study<sup>103</sup> developed by the company Value Partners for the ATM Industry Association (ATMIA) shows that the growth rate, transaction volume, and values of automated tellers are very different among local regions, though in these segments they mostly exceed their GDP growth rates (2014:7). The study highlights the disparities of the cost of cash, hardware, and transaction processing within the retail banking sector, despite the similarities of tasks performed by automated tellers. In this sense, companies that independently deploy these machines “have the ATM as a main line of business but for banks, in particular, the ATM is a channel that is complementary to other services and often leverages purely as on a cost-substitution basis” (ATMIA 2014:8). Over 2.75 million automatic tellers are currently estimated to be installed

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<sup>103</sup> [http://www.valuepartners.com/downloads/PDF\\_Comunicati/2014.02-ATMIA-and-Value-Partners-ATM-Benchmarking-and-Industry-report-report.pdf](http://www.valuepartners.com/downloads/PDF_Comunicati/2014.02-ATMIA-and-Value-Partners-ATM-Benchmarking-and-Industry-report-report.pdf) (last accessed 17/06/2016)

world wide, and ATMIA's study shows a 17% percent increase of this figure within the next three years. Wikipedia's ATM entry also tells us that four regions (US, Canada, Europe, and Japan) have the highest number of automated teller machines per million people, while ATMIA's study estimates the total amount of cash dispensed in 2013 by all these automated tellers at approximately \$10.47 trillion (US Dollars). The Asia and Pacific regions concentrate the largest total of automated tellers installed (1.2 million units) and are the fastest growing markets (12%), along with the Middle-East & Africa (12%) since 2006. While indicating a grow of 6% over the same period, Europe ranks second in the global amount of available machines (0.6 million units). The North American region follows with 0.45 million automatic teller machines, but showing a marginal increase of units shipped (3%) since 2006. Central & South America's market has grown 4% in the past eight years, totalling roughly more than 0.3 million of available units. In short, these figures of ATMIA's research posit the ongoing strategic importance of the automated teller machine to distribute cash, notwithstanding the rapid emergence of electronic payment systems, as well as the modest uprising of crypto-currencies.

Coining the networked automated teller machine also created a business niche for developing infrastructures for moving data. Interbank networks are a mingled landscape of companies and standards, so that entangling automated tellers entails authorizing financial transactions over protocol shaped channels – such as the ISO 8583 standard for exchanging messages during financial transactions – owned by interbank networks such as NYCE, PULSE, PLUS, Cirrus, AFFN, Interac, Interswitch, STAR, LINK, MegaLink and BancNet (Wikipedia's ATM entry).<sup>104</sup> Most of the movement of data through such networks of automated tellers is channelled by telephone lines, and often via ADSL and dial-up modems, though high traffic machines preferably use private or leased lines. Fees for transactions are the order of the day in many cash points. During 2013 the global amount of transactions of interbank networks peaked just

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<sup>104</sup> Retrieved from [http://en.wikipedia.org/wiki/Automated\\_teller\\_machine](http://en.wikipedia.org/wiki/Automated_teller_machine) (last accessed 26/06/2016)

below 70 billion connections (ATMIA 2014). So I may grasp, as I touch this hole in the wall, the UK interbank network called LINK, an entanglement of nearly 2,5 billion cash withdrawals and 1.3 billion of other transactions made in 2015, and with an estimated circulation of £127,8 billion.<sup>105</sup> From LINK's website we also learn that all automated tellers in the UK (approximately 70,600 in 2015) exchange transactions through this interbank network, and 75% of these machines are “free to use”.<sup>106</sup>

## Neoliberal optics

All of these stories and figures help to disclose what we buy into when we withdraw cash from automated tellers. With Mark Hayward and his examination of ATMs, teleprompters, and photobooths (2013), I could suggest that these devices point to a short history of neoliberal optics, a term Hayward proposes to name “the uses of light that contribute to forms of sociality and subjectivity that constitute neoliberal culture” (2013:194). Hayward explains that a neoliberal culture tends to shape or articulate (the elements of) the self and the body of the user via technological means, and to optically produce “the appropriation of forms of direct, personal address in order to maintain and exploit affective engagement on the part of individual towards institutions” (Hayward 203:194).

Hayward's neoliberal optics help me to stress how cash points may be agential apparatuses that enforce regimes of individuation (2013:195), configuring places with machinic optics and arrangements through which people are called to inhabit life-styles textured by the modes of existence of neoliberalism. To examine what exactly is neoliberal about the automated teller,

<sup>105</sup> <http://www.link.co.uk/about-link/statistics/> (last accessed 17/06/2016)

<sup>106</sup> Automatic teller machines of this interbank network are mostly hosted by the Bank of Ireland (2,872), Cardtronics (16,069), Barclays (4,146), DC Payments (6,168), Halifax (1,935), HSBC (2,363), Lloyds Bank (2,822), NatWest (3,747), NoteMachine (8,704), PayPoint (4,224), the Royal Bank of Scotland (4,172), Santander (2,327), and YourCash (3,637).

Hayward notes that Simjian's automatic teller machine, in contrast to the photobooth and the teleprompter – which materialize a sense of optics inherited from the studies of light in the nineteenth century, as described by Jonathan Crary<sup>107</sup> – created instead a banking practice that fragmented and distributed the individual. Automated tellers would no longer insist on embedding vision to stabilize the human body. Unlike photobooths and teleprompters, which immobilize and capture subjects facing a camera, automated tellers work by grasping a few fragments of the user (e.g. a plastic card, a PIN number, a biometric pattern) to identify and so screen her as a bank customer. In this way bank customers get cash away from the counter, a translation afforded by the machinic infrastructures built since the 1970s for automated tellers. Nevertheless, this reconfiguration of customers beyond the bank counter entails, according to Hayward, extending an affective power onto the user's body (Hayward 2013:198). Like the photobooth and the teleprompter, this power persuades people to disclose their identities daily as individual bank customers. This effects a regime of individuation, through which a neoliberal economy<sup>108</sup> may become a part of mundane life, through an apparatus like the automated teller.

In this sense, what happens with automated tellers is indeed very different than what happens with self checkouts, insofar as in their use of the latter people can avoid disclosing themselves as identifiable sources of further profit. Of course at the supermarket there are many other ways of making shoppers more profitable; for example, goods may be displayed around the aisles of the shopping floor in ways that encourage customers to collect them. But, at the cash point, power works with a more personal touch. Users are persuaded to collect cash *only* in exchange for their personal data. In this way, it becomes tricky for me as a user to move sideways from the calculations or algorithms of automated tellers, as they generate logs and individual profiles that

<sup>107</sup> The study of optics in the nineteenth century, according to Crary, was far more interested in “the makeup of the human subject, rather than [in] the mechanics of light and optical transmission” (1992:70 cited in Hayward 2013:196).

<sup>108</sup> What is a “neoliberal economy”? This can be contested on both scholarly and practical grounds, but what I am referring to here is how automated tellers that lure people to disclose themselves as profitable individuals are authorized by a set of economical, political, and legal practices.

inform retail and financial markets how to profit from me further. Against this I read the automated teller with a different Inka figure, the pukara, the *topos* of the Inka fortress. As the pukara enfolds a place where daily encounters are partly aligned by walls, they are helpful to sketch how the automated teller persuades people to face a line in the centre: an alignment in which users interact, through the interface, with a machinic power that configures them as individuals beyond the bank, and with an embodied power that addresses them individually.<sup>109</sup>

Let's consider how the powers of affective engagement may be deployed in relation to users of automated tellers. Hayward follows Mark Hansen to assert that a body does not vanish when connected to a stream of information. When the visual becomes digitalized, bodies remain an affective, fleshy experience of space. In other words, Hansen's digital bodies are haptic – “a modality of spacing that has been wholly detached from vision, that has become affective” (2004:230 cited in Hayward 2013:201). Hayward coins the phrase “neoliberal optics” for this affective engagement<sup>110</sup> with the optical features of machines, insofar they afford spaces for regimes of exploitation and expropriation under neoliberalism. Neoliberal optics outlines enactments of graphical interfaces that lure users to become well known customers, and thus profitable individuals. Asking for trust in the exchange of cash and distrusting those who are undisclosed, or

<sup>109</sup> In this sense, because of the similarities between the neoliberal affective powers of the teleprompter and the automated teller, Hayward asserts that Simjian's contribution: “must be interpreted as more than simply a contribution to the technological infrastructure of television, but a material shift in those techniques which structure norms about how to present oneself while on screen as natural and comfortable before a physically absent audience. There are a variety of venues in which the modes of address made possible by the teleprompter have been operationalised including, as will be discussed below, the ATM. Common across all these areas [...] is the relationship that the modes of address have to engagement, trust as well as more ephemeral forms of affective connection connoted by the ideas of the 'personal touch'. In this way, the contribution that the teleprompter made to the production of televisual intimacy starting in the 1950s must be situated as enabling support for the increasingly important role that affects plays, whether as part of a process for identity formation or as productive labour itself, within the reconfiguration of the division between personal and public life and the distinction between cognitive and physical activity that defines the regime of exploitation and expropriation under neoliberalism” (Hayward 2013:198).

<sup>110</sup> For quite different reasons, a sense of affective engagement with automated tellers is also invoked by ATMIA's study, where we are invited to imagine these machines as touch-points between the customer and the banks – which is the kind of concern addressed by neoliberal optics. “The ATM industry's offering has evolved significantly since its inception in the early 1960s, becoming a key enabler of branch innovation, and now evolving in parallel to internet banking and newly developing mobile banking channel, developing its role from a pure teller substitution / cash dispensing service to being one of, if not in many cases, the most important touch-point between a financial services organisation and its retail and SME customers” (2014:9).

identified as an other than the bank customer, automated tellers enfold people into particular banking practices. Such folds entail meeting, at the cash point, a line in the centre – a line that becomes a fold through an encounter with an apparatus, a mundane fold that concerned the observers of early automated tellers, such as the Bankograph and the Bankomat, because it envelops how these self service machines affect people's lives. If these holes in the walls are folds in this sense, Hayward's affective engagements can be considered as encounters with the automated teller's line in the centre, a becoming with, in the prosaic poiesis or enfolding of everyday life.

## Filling up topologies

Scholars of everyday life, in their different ways, have undertaken studies that see the prosaic encounters of people and things as never trivial, but always critical for the constitution and maintenance of mundane capacities for action.<sup>111</sup> I want to write with a topological imagination to suggest and inhabit a sense of the everyday which is not defined through engagements with an external, natural or social world produced in advance as life's container. Instead, I follow practical meetings<sup>112</sup> that draw attention to the material-semiotic actors that Haraway encourages, and a sense of daily life that is a multipartner dance or an encounter in which identities that emerge within “a relational web opening to non-Euclidean pasts, presents, and futures” (2008:32).<sup>113</sup> I attune my

<sup>111</sup> For instance, Mikhail Bakthin writes against the opinion that meaning of the mundane must be produced exclusively from “such external value-spheres as philosophy, religion or politics” (Gardiner 2000:50). By drawing from a disparate collection of phenomenological and process thinkers – such as Husserl, Bergson, and Merleau-Ponty – Bakthin aptly conveys how being always entails to grasp, prior to rationalization, an experience of everyday events: “Being-as-Event must be therefore lived through, and not passively comprehended from apart” (Gardiner 2000:50). Rooting being as event, people's actions stem from mundane life, so Bakthin situates the everyday in the rhythms and textures of prosaic lived experience.

<sup>112</sup> For Lefebvre, “praxis [even within a dialectical framework] is not restricted to the utilitarian transformation of external nature through repetitive, instrumental action. It also involves love, sensuality, the body – a plethora of creative, emotive and imaginative practices Lefebvre calls *poiesis*” (Gardiner 2000:80).

<sup>113</sup> See chapter 2. Haraway situates her sense of material-semiotic actors, particularly those she calls companion species (2008), relentlessly across any essentialist boundary of the natural and the social, emerging through a “becoming with” in open ended and constitutive relationships. “The shape and temporality of life on earth are more like a liquid-crystal consortium folding on itself again and again than a well-branched tree. Ordinary identities emerge and are rightly cherished, but they remain always a relational web opening to non-Euclidean pasts, presents, and futures. The ordinary is a multipartner mud dance issuing from and in entangled species. It is turtles all the way down; the partners do not preexist their constitutive intra-action at every folded layer of space and time. These are the contagions and infections that wound the primary narcissism of those who still dream of human exceptionalism.

fingeryeyes with a material-semiotic sense of reading actors topologically, to unpack the spatialities of automated tellers, and to suggest a way of moving sideways.

Tracing the influence of topological thinking in social and cultural theory, Celia Lury, Luciana Parisi and Tiziana Terranova argue that “culture itself” is now increasingly becoming topological (2012). They explain how the study of this cultural shift – coined as a “turn to the surface” – was initially developed by Sigfried Kracauer, who paid attention to how people and things can have an elected affinity with a surface, such as the alignment of furniture in hotel lobbies, the coordination of bodies in dance groups, or the ordering of words and images in newspapers. Kracauer noted with these examples that cultural forms may be introduced in a situation by way of a ratio, so that what may be performed becomes a 'demonstration of mathematics' and who performs must be understood rationally. The reason at work in these mundane configurations is then one of a specific mathematical logic, an Euclidean geometry grasped by people to create a mass ornament on the surface (Lury et al. 2012:4). But a new mathematical logic would be articulating what is now proposed as a cultural shift: “a new rationality is emerging: the moving ratio of a topological culture” (2012:4). This reshaping of culture would take place as the surfacing of social order becomes 'unfixed' from Euclidean geometry. In turn, a more dynamic ordering of spatio-temporal continuity emerges with various topological forms of economic, political and cultural life. This order grows from practices of sorting, numbering, labelling comparing, listing, and calculating, all introducing a sense of constantly changing deformation that becomes culturally established as constant, normal, and immanent – rather than as occasional, extraordinary and endogenously produced (Lury et al. 2012:4).

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These are also the cobblings together that give meaning to the “becoming with” of companion species in naturecultures” (Haraway 2008:32).

Insofar as the effect of these ordering practices is to bring “new continuities into a discontinuous world by establishing equivalences or similitudes, and to make and mark discontinuities through repeated contrasts [so that] the topological cultural forms (or constantly changing deformation) of lists, models, networks, clouds, fractals, and flows proliferate” (Lury et al. 2012:4), it seems useful to detail what Lury et. al mean by discontinuity, as something to be grasped by reading spatial patterns with topological figures such as networks, fractals, etc. Thus when Lury et al. talk about a production of (new) continuities into a discontinuous world, my reading is that they are conceptually aiming at a cultural shift with topology to say that places may remain connected by stretching continuities such as paths, hyperlinks, etc. But also, more importantly, they are suggesting that space may be produced in non-Euclidean terms through ordering practices, and this would increasingly matter for the prosaic poiesis of the social.<sup>114</sup> Perhaps this can be exemplified with the stretching<sup>115</sup> of sociotechnical networks during the so called great acceleration period<sup>116</sup> expanded during the twentieth century “with similar if not even more extreme consequences” (May & Thrift 2001:9); notwithstanding the asymmetric distribution of “new technologies of transport and communication, speed and light, of new systems of social regulation and time-discipline, and of new ideas as to the basic qualities of time and space” (May & Thrift 2001:18).

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<sup>114</sup> “The becoming topological of culture does not simply correspond to how culture imagines topology: instead, our proposal is that topology is now emergent in the practices of ordering, modelling, networking and mapping that co-constitute culture, technology and science. In short, a distributed, dynamic configuration of practices is organizing the forms of social life in ways that supplement and extend those of Euclidean geometry” (Lury et al. 2012:5).

<sup>115</sup> ‘Stretching’ a continuity is also suggestive of the consecutive ‘compression’ of space and time (Harvey 1989). Still, “in terms of space, it not simply that a sense of geographical distance has been radically compressed, but that more familiar understandings of location and position might have to be abandoned altogether (Shields 1992)” (May & Thrift 2001:9).

<sup>116</sup> “Certainly, when considering the period from the middle of the nineteenth century to the outbreak of the First World War it is difficult to avoid the conclusion that there occurred a radical if not revolutionary change in the nature and experience of both space and time through those years. So too, for both living through them and those subsequently mapping these changes, the overwhelming impression seems to have been one of radical compression of spatial and temporal horizons – a notion captured in contemporary accounts of a ‘great acceleration’ or the progressive ‘annihilation of space by time’ (Marx 1987). Indeed, as the century progressed evidence as to this ‘great acceleration’ was everywhere apparent, discussed most frequently both at the time and since in relation to a series of developments in transport and communication technologies out of which it is in turn usually understood as having arisen” (May & Thrift 2001:7).

Lury et al. orient their discussion of spatio-temporal transformations of contemporary culture by working with an insightful conception of dis/continuities borrowed from topology, situating their reading of culture through the characterization of the influences of topological thinking styles in social and cultural theory (2012:7-13). Showing how topological approaches travel between different knowledges, Lury et al. then draw from the attention to hair-splitting practices of mediation in the work of Michel Serres and Bruno Latour, as well as from the cultural changes of windows, mirrors, and screens<sup>117</sup> tackled by Lev Manovich, Anne Friedberg, Beatrice Colomina, Gilles Deleuze, and Mary-Ann Doane, to propose how surfaces act<sup>118</sup> in topological culture.<sup>119</sup>

Nigel Thrift and colleagues have published collections that point to the influences of topological thinking in Geography (Crang & Thrift 2000; May & Thrift 2001). Among other examples of the contribution of topology to different styles of thought, Scott Lash (2012:216) formulated a proposition that resonates with Lury et al.'s sense of a becoming topological of culture, asserting that "topology is integral to a shift in socio-cultural theory from a linguistic to a mathematical paradigm."<sup>120</sup> Taking the imaginary as central to consider this shift, both Lash and Lury et al. connect their topological conceptions of contemporary culture to a sense of self-production, either as a self-organizing socio-technical imaginary<sup>121</sup> (Lash 2012:277) or as auto-

<sup>117</sup> In particular, from the movement of the television and the computer screen "out of the box and into the environment," as studied by Katherine Hayles (Gane et al. 2007:349 cited in Lury et al. 2012:11).

<sup>118</sup> "[...] the operations of invariance in topological geometry – ordering and continuity – are, by contrast with Euclidean Geometry, more general. Crucially, they mean that invariance and intrinsic change (understood as deformation) are not incompatible; rather they are rigorously inter-related. Put another way, topology is the setting up of spaces of different kinds of order and continuity in such a way as to enable deformation or change, what Massumi (2002) calls the continuity of transformation. Alternatively, we can describe a topological surface as 'a relational field of emergence' (Parisi 2012, Manning 2009)" (Lury et al. 2012:8).

<sup>119</sup> The emergence of topological culture would not be confined to communication media. Lury et al. draw from political concepts, such as Etienne Balibar's sense of border or Penny Harvey's description of large-scale road construction in Peru, to grasp more broadly how "a topological ratio can be seen to be emerging in processes of mediation" (Lury et al. 2012:13).

<sup>120</sup> "This has enabled in Badiou and Žižek a critique of the symbolic register, understood in terms of pure conceptual abstraction. Drawing on topology [I understand their critique] instead in terms of the *figure*. The break with the symbolic and language necessitates a break with form, but topologically still preserves a logic of the figure. This becomes a process of figuration, indeed a process of 'deformation'" (Lash 2012:261).

<sup>121</sup> "As a process of largely self-determining figurations, the social imaginary is also temporal [...] In the 21<sup>st</sup> century, this social imaginary takes the form of a system. There was always technology. But there is a tipping point at which

spatialization (Lury et al. 2012:13). But this alleged autopoiesis begs the question, at least in the case of self service practices, of which selves are reproduced under the hood, so to speak, of the figure of an observer in those imagined spaces. For me, the trouble stems from the “view that topological culture is a form of practical abstraction” (Toscano 2008, cited in Lury et al. 2012:12), without making clear how topology allows practices of abstraction *into* specific locations rather than abstraction *from* cultural situations.<sup>122</sup> Moreover, at stake is the definition of what counts as topology<sup>123</sup> and so how culture may be read topologically. If topology is taken as a set-point abstraction *from* space, my concern echoes Henri Poincaré's complaint that “set theory was the disease of the 19<sup>th</sup> century”<sup>124</sup> (cited Lury et al. 2012:22). In any case, taking topology as an abstraction *from* culture<sup>125</sup> runs the conceptual risk of imagining “a Platonic universe of ideal abstract multiplicities without histories or any relation to bodies” (Rotman 2012:250). Thus I suggest below how a generative use of figures in surface topologies allows us to imagine the spatialities of locations, like the cash point, by abstracting low dimensional manifolds *into* situations without disjoining spaces and selves, but rather cutting them agentially through a course of action. Inspired by the etymology of the word algebra,<sup>126</sup> I am not concerned with the so-called

human subjects become integrally ensconced in human-technical systems – with the predominance of ubiquitous media, a range of technologies, the image-society, brands and consumer capitalism. Social systems, once rightly described as structural-functional by Parsons, become increasingly communications systems, Luhmann's (1995) semantic systems” (Lash 2012:277). But it seems for me difficult to reconcile this sense of self-figuration when borrowing from Niklas Luhmann's theory of autopoietic social systems. Lash seems to forget the large debt of Luhmann to George Spencer-Brown's “Laws of Form” (1972) – a seminal foundation of mathematics – which eclipses the alleged centrality of the imaginary without the real. For a great example of how the real and the imaginary may be fused to articulate mathematics, with figures enacted as forms, see George Bennett-Stuart's markable marks: [http://www.markability.net/site\\_map.htm](http://www.markability.net/site_map.htm) (last accessed 15/06/2016)

<sup>122</sup> Insofar the 'becoming topological' of culture says nothing about nature, then 'abstraction from' a situation seems to me a form of purification (Latour 1993).

<sup>123</sup> “One of the most basic problems in topology is to determine when two topological spaces are the same, that is, when they can be identified with one another in a continuous way. This has been called the 'Poincaré Conjecture', marking the beginning of algebraic topology (Eynde 1999:82-87; Rotman 2012)” (Lury et al. 2012:29).

<sup>124</sup> For a more contemporary conception of sets in social practice, see Adrian MacKenzie's (2012) reading of the proliferation of sets and forms of set-making.

<sup>125</sup> A style well exemplified by Alan Badiou.

<sup>126</sup> Poincaré is closely related to the development of algebraic topology through his concepts of homotopy and homology – both referring to invariants under constant change or deformation. The word algebra refers to the Arabic *al-jabr*: ‘the reunion of broken parts’, ‘bone-setting’, from *jabara*: ‘reunite, restore’. All these meanings point to ‘the surgical treatment of fractures’. The mathematical sense of the word comes from the title of the book ‘ilm al-jabr wa'l-muqābala ‘the science of restoring what is missing and equating like with like’, by the mathematician al-Kwārizmī.

becoming topological of culture,<sup>127</sup> but rather with matters of reading specific locations with topology to make space for moving sideways and opening up, in this case, the protection of currencies within a regime that lures people to disclose themselves as profitable individuals. For me, if the spatialities of the self services afforded by automated tellers are topological, the question is how to use figures to reimagine their locations as places to secure particular optics and economies, through actions like computing and screening a circulation of currencies.

Note how with the supermarket self checkouts examined in the previous chapter, we unpacked how the self service purchase (the troubles of collecting items) was aligned by the machine's bounding of the shopping floor. However, in the case of the automated teller two considerable differences in the way that their screens align a course of action become apparent. Cash points do not fully envelop the space where a course of action takes place. In contrast to purchase points, queues around automated tellers can be particularly aligned "in the wild", not supported with props to shape them. Likewise, bank employees rarely sort out the troubles when things get messy or out of order. Also things in the supermarket may appear articulated to profit from shoppers, but people do not have to disclose themselves as profitable individuals through the purchase. Shoppers can pay with cash to avoid using a debit, credit, or loyalty card. The opposite happens at the self service cash point as automated tellers persuade people to identify themselves as bank clients. They are profiled as distinct users with a gender, age, address, account number, etc., aggregated in data sets of well known customers, addressed as a population, and touched affectively by banks that wager on their calculations of credit risk.

These differences have important consequences for the potential openings of moving sideways. Below I detail how stopping by the cash point entails, more evidently than when

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<sup>127</sup> Alternatively, one may propose that culture has always been topological, so that Lury et al. may be grasping a sociotechnical reconfiguration where non Euclidean manifolds are increasingly as relevant as Euclidean surfaces for everyday life.

purchasing at the supermarket, stretching a course of action by “filling up” or restoring what is missing when breakdowns take place. I will outline automated tellers with figures of low dimensional manifolds, to sketch how sustaining a course of action is a mundane practice of filling up topologies, through movements in which breakdowns are agential and generative cuts. In this sense, the material duration or performative resistance of making a withdrawal of cash through the interfaces of automated tellers may also be practised as a resistance to the line in the centre. This is done not as confrontation or destruction but as a prosaic move sideways, from the powers that affect users when banks seek to profit from them. Such resistance aims to open up passages for all kinds of “cracks and fissures [that] appear in the smooth wall of controlled consumption and the visage of ubiquitous panoptic power [...] So Lefebvre suggests that late modernity is marked by the appearance of an 'elaborated body' that resists the homogenizing abstractions of bureaucratic neo-capitalism” (Gardiner 2000:96). To elaborate this body is an assembling and devising task that may become an alternative to confronting or destroying the making of profitable individuals at the cash point. But how may bodies resist Hayward's affective engagement towards the bank? How may people stretch the making of knots for living “spaces of freedom and *jouissance*? ” (Lefebvre 1988:82 cited in Gardiner 2000:96).

### **Torus space**

I have delineated how the automated teller's line in the centre enfolds a banking practice with a regime of individuation. And with pukaras, I signalled how facing a line in the centre means encountering (through the interface) an embodied and a machinic power. Resonating now with the figures of time outlined in the last chapter, I will sketch with closed two-dimensional manifolds (i.e. the torus, the sphere, the Klein bottle, and the projective plane) how people may embody spatial patterns to pass through an automated teller by filling up topologies around, through, and away

from a cash point.

Let's go back then to the automated teller I approached by drawing an L shaped figure in order to queue between a wall and the market in Penny Street. This is an example of a specific moment of embodiment of a spatial pattern enacted in order to withdraw cash. In the previous chapter I read such particular moments of queuing as a temporal pattern around supermarket self checkouts, a moment of plotting the queue on the shopping floor with other shoppers' bodies, a movement that now I read on Penny street as a spatial patterning of bank customers, a specific L shaped alignment of people moving around the automated teller, a movement towards a point of service.

For Harold Garfinkel and Eric Livingstone, people in queues are "incessantly busied positioning themselves so as to exhibit the real existence of an order of service" (2003:21). Audiovisual details appear as fundamental for this mundane task of producing and locating the setting's:

phenomenal field of designed enterprises: oriented objects, directional, orientational, positional, place, placement, distanced, facings, rotational, and normal passing looks of things, perspectival, aspects, approaches, inner, outer, and temporal horizontal properties, in and as of embodied visual details of witnessable things. These are produced in accountable coherent technical particulars of the setting's immortality, and in just that immortality's witnessable details, its witnessable generality (Garfinkel & Livingstone 2003:21).

In this suggestive articulation of queues, Garfinkel and Livingstone focus on grasping queues ethnographically through their specific features, which people exhibit by ordering the

alignment in practices of spatialization: bodies orienting, facing, entering, approaching, rotating exiting, etc., the queue by moving around, through, and away from the particular details of this collective setting. Queues are then embodied spatial patterns, an endogenously produced organization (Garfinkel and Livingstone 2003:21) of bodies attentive to the details of places in which they shape the space in between each other. Note how such an endogenous ordering device assembles the queue with a line, a material-semiotic actor made of people and things heterogeneously realizing Garfinkel and Livingstone's order of service. In this sense, I am interested in considering queues as embodied spacing: a bodily placement of space, a place of bodies and for bodies to collectively wait for, and move in an orderly way towards, a machinic point of service, an endogenously produced organization that is prevalent, ordinarily local and locally produced and recognized, lexically and gesturally produced in-line through talking bodies, empirically detailed through the witnessable features of this 'phenomenal field', through the properties of this local population cohort of people, keeping themselves busy with the prosaic enterprise of designing a service line of parties making "the line that appears" (Garfinkel and Livingstone 2003:21-25), a line that signals the embodiment of a mutably mobile pattern of becoming.<sup>128</sup>

Queues are alignments that follow a sense of distance in between the bodies that wait, particularly shaped through remaining in touchless touch with the queue. Queues entail an estimation of distances, a calculative sense I qualified with Cochoy's notion of calculation (2008:30), a talk of bodies tracing the spatialities of an "immortal queue, a queue that could continue indefinitely" (Garfinkel & Livingstone 2003:26), a queue that is constitutive of the subjects becoming this alignment of people, all intra-acting with what helps them to sort out (assemble) a line in a particular location (Fraser 2006:199). There is a spatial patterning, a distinctive kind of space for this creative plot time of queues, indicative of the relational and

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<sup>128</sup> See Law and Singleton (2005).

generative gesture of remaining in touchless touch. I think queues resonate with a trace-like figuration of bodies, above all with a sense of worldly wide webs of mutably mobile actor-networks.

This spatial patterning has been widely conceptualized in studies of technoscience,<sup>129</sup> nevertheless, it strikes me how often the very figure of the network as an allegory remains unproblematic. Granted that queues are fleshy rather than abstract sets of nodes and relations represented with maps and plotted on flat surfaces, how do we propose a topology that may be an alternative to this Euclidean geometry of networks? As discussed in the previous sections, the spaces of queuing bodies, read with close two-dimensional manifolds, may offer a mundane detailing of how lines, bodies, and spaces intra-act in the patterning of places to queue around things.

Becoming a subject of a queue is a mundane achievement exhibited by rotating, fragmenting, or dissolving a line that enfolds people into a particular, embodied pattern of movement. For instance, L shaped alignments of the queue are afforded by people bending the pattern to run parallel to something that leaves little space to queue, as mentioned above and pictured by my biomechanical eye in Manchester, UK (figure 55). Note how the queue moves sideways from a circle of nearby bodies, and also parallel to the public street, an articulation attained by the queuing people, folding those lines outside. In this sense, the queue is a concealment, a prosaic pleat that can be read with pukaras as holding still the open ended distinction between the insides and outsides of the alignment. In practice, queues are fragile, slippery, “the properties of a queue’s apparent coherence in its details is elusive” (Garfinkel and Livingstone 2003:25). Queues can be dismembered, disbanded, disintegrated, partially or fully dissolved. So by stretching and cutting positions for bodies in the queue, people can extend

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<sup>129</sup> See Law and Hassard (1999), Law and Mol (2001, 2002), Law and Singleton (2005), and Law and Moser (2006).

whatever may circulate through and break down the alignment. Stands and stripes can then materialize a sense of resistance for people to screen the queue, a resistance enveloped into the queue as a detail of the alignment, a fold to manage the task of attending to the place in which people shape the space in between each other, the space from where a line grows, moves and mutates, the space where people become a queue. Note as well how the alignment is broken by bodies moving across the space left in between queuing people (figure 56), a space arranged by people filling up that place on the sidewalk with a line, a place in which they can remain in touchless touch, resist losing grasp of each other's bodies, restore what is missing in between the gaps.

**Figure 55.** L queue line  
(photograph by author)



**Figure 56.** Restoring the queue  
(photograph by author)



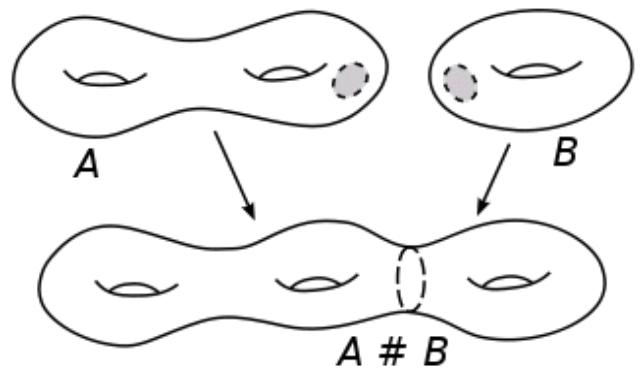
Reading the connections of the space left by the bodies in these queues topologically underlines how people agentially cut (i.e. performatively locate) their positioning or alignment through a course of action. This grasping of the queue entails detailing how the line, the “witnessable apparent coherence of the order of service” (Garfinkel and Livingstone 2003:25)

grows with the witnessable apparent non coherence<sup>130</sup> of the phenomenal field. In other words, people always grapple more or less with the mess of the places co-produced with a queue line, bodies in-line inter-intra act with what travels through the queue, and with people and things moving around and away from the line. So multiple lines (figure 57) may grow from the queue, requiring people to stay in touch with the queue's shape by figuring its connections (topology) rather than its characteristics (geometry) – by attending to its links rather than its features. This line that could continue indefinitely actually does not, by bounding particular subjects, the queuing people, into a pattern, a kind of connectivity, a topology, rather than a geometry of individual positions locatable on the street. It is a positioning, a patterning, a connectivity that can be suggested as fleshed by the bodies queuing on that particular place, stretching a kind of spatiality. This making of space or spacing could continue indefinitely, but actually does not, as it enfolds and cuts people, together and apart, in a queue, in a shaping of a figure.

**Figure 57.** Multiple lines  
(photograph by author)



**Figure 58.** Sum of tori



<sup>130</sup> Following Law (2004), non coherence is not incoherence or nonsense but orderings that are not congruent with each other. In the case of queues, multiple orders may traverse the space between the bodies from which 'the line that appears' grows.

Insofar as this figure may be stretched by focusing on the connections rather than the characteristics of a queue, it can be imagined topologically as a torus: as space lived by filling a place up with a fold embodied around the gaps between queuing people, a place to remain in touchless touch, to grasp each other's patterning, and to restore the figure when the links are punctured. A torus is the space of a two-dimensional manifold, a finite surface of a three-dimensional figure. Tori are any thing shaped like doughnuts by revolving a circle around a coplanar axis; tropes to sketch daily life since “the surface of any solid object [or subject] in everyday life is a bounded [or a finite] set in three-dimensional space” (Firby and Gardiner 1991:20).

To read queues with tori, first note how the surface of anyone can be reimagined topologically as deformable, like a rubber sheet. Some daily things (e.g. coffee cups, pierced bodies) may be then stretched, deformed, and so become a torus, while the rest (i.e. anything without a hole) can be distorted into a sphere, without tearing them apart. Surfaces are homeomorphic<sup>131</sup> for topologists insofar “one of the space models [or the figures] can be continuously distorted to look like the other” (Firby and Gardiner 1991:20). In this sense, a torus cannot become a sphere in topology because the gap of a torus cannot be 'glued', one cannot transform one into the other. In other words, one can differentiate them. On the other hand, manifolds, like the torus or the sphere, may be added to each other. With these insights, let's consider that people in queues may stretch themselves as a sum of tori (figure 58): a figure connecting the gaps that suggests a way to read and reimagine queues, as the linking of space around the breakdowns of the line, positionings around the gaps of a sum of aligned bodies, stretching and cutting themselves through each queuing position, so leaving space between themselves to sketch a coherent line, and to allocate the non coherence of assembling a place to queue. In this placement of queues, in this way of reading spatially the gaps of a line : the

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<sup>131</sup> A relation of similarity rather than of sameness.

breakdowns of an alignment : the holes of a queue : are generative agential cuts as who passes through this space may break down and thus subvert the line as a daily queuing device : as a creature of the queue. This means for anybody to remain aligned by filling up constantly the topology of the queue (what remains under constant change), or alternatively by sketching the queue differently, by following the multiple conduits underlined by people and things moving across the alignment, the various lines this queue could alternatively follow, the passages to abandon the queue while still waiting in line. Those who stay in the queue may leave it, after waiting in the first position, by taking the queue's exit passage, which leads in this case to an automated teller.

For me, a torus helps to refigure nodes and relations by eschewing the Euclidean or flat model of space in which they can be traced as links connecting nodes on a plane, a mode of mapping to navigate across places by looking down at them, by gazing from above. Let's then imagine this refiguration as a transformation of a plane into a torus. Fold a plane along a link connecting two nodes on it: the fold transforms the plane into a cylinder. Then fold again this cylinder into a torus: the fold connects both open ends. In this way, any mapped point or node linked with a relation on a plane can be refigured by folding along the connections. If this transformation is applied to all the nodes and relations on a map, then it becomes a sum of tori. Evidently this map loses all its geometrical capacity to signal size or location. Nevertheless, it acquires figures that are attuned not only to coherent alignments, as detailed with the case of queues, but also to the non coherence resulting from other configurations intersecting with those alignments. This is precisely the kind of textures that appear manifestly absent from maps, representing places without taking into account how they are always co-produced, in particular situations, with a specific course of action such as queuing, and an apparatus like the automated teller.

## Sphere space

A plane can be refigured into a sphere as well. Fold into a single point the perimeter, or boundary line, of the plane. Spheres are topologically equivalent to any figure without a hole. Spheres can be deformed into any three-dimensional shape that resembles an enclosure or a container: the surface of a concealed space. Thus spheres can resonate well with a specific modelling of place. In particular when a sphere is stretched into a cube, it overlaps with an Euclidean imaginary, a framework that informs much of Western epistemology, a model that pictures space as a container<sup>132</sup> of processes without history, a “neutral backdrop against which events unfold” (Barad 2007:224). This model of people without bodies-in-the-making, things without contingent temporalities (Barad 2007:223-224) seems appealing for the prediction of events: for killing time in advance. It seems as if people and things, when enfolded into this container model of space, become attached to the flow of a clock, to a specific rhythm or conversion of time's duration (Canales 2015), or a movement implicated in perceptions of time (Galison 2003).

Note how during the opening and closing hours of a place, like a supermarket, when imagined as contained *in* space, the flow of (more or less) synchronized clocks relentlessly convenes time, once and for all. Instead of using the sphere to picture this model of an immutable geometry of space,<sup>133</sup> I want to propose with spheres, as topological figures, that the concealment of space is a mundane achievement. It is a performance of people and bodies, enfolding a place into a container, a booth or a building, a prosaic pleat that can be read with pukaras as fixing the open

<sup>132</sup> “Spatialization as a never-ending, power-laced process engaged by a motley array of beings can be fetishized as a series of maps whose grids nontropically locate naturally bounded bodies (land, people, resources – and genes) inside ‘absolute’ dimensions such as space and time. The maps are fetishes in so far as they enable a specific kind of mistake that turns process into nontropic, real, literal things inside containers” (Haraway 1997:136 cited in Barad 2007:224).

<sup>133</sup> “The classical object that we encounter – as most forcefully and powerfully delineated by Kant – is a form in something like a ‘container space’. As such it is ‘topographical’. Topology will take us beyond this classical object and form. Yet it will remain geometrical and spatial and as such does not take us beyond the *figure*” (Lash 2012:261-262, *italics in original*).

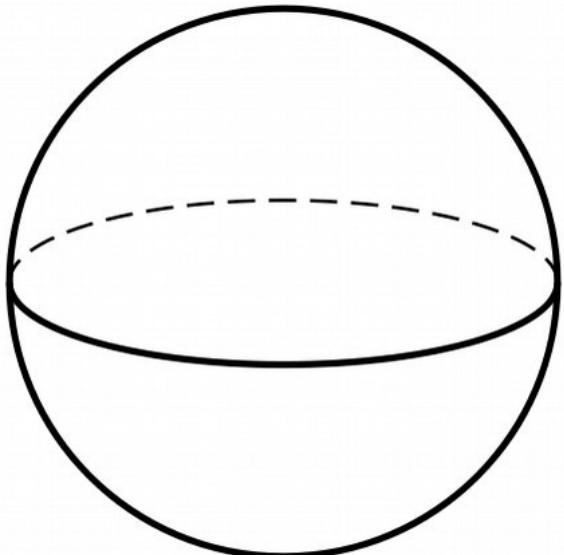
ended distinction between the insides and outsides of a fortification. With spheres, I make space for a figure to read places when modelled as non punctured containers of the movement of people and things patterned by clocks. I detailed previously this moment of movement as a temporal pattern around the timing of opening and closing hours of the supermarket, shaping the movements of the insides and outsides of the shopping floor, ticking the moments in which customers and employees come to move around, through, and away from the checkout points, and then leave. I think there is for these clocks, plotting time in advance, a distinctive spatial patterning. This pattern echoes the relational and generative gesture of remaining in touch, and concealing through contact: spheres are helpful figures to sketch this double effect. In this sense, resonating with the walls of pukaras as well, spheres are suggestive of the double task of displaying and concealing money with automated tellers. With spheres, and with spheres within spheres, I sketch the light and shadows of this apparatus.

**Figure 59.** Vaults

(photograph by author)<sup>134</sup>



**Figure 60.** Sphere



<sup>134</sup> Taken in Alexandra Square, Lancaster University, UK.

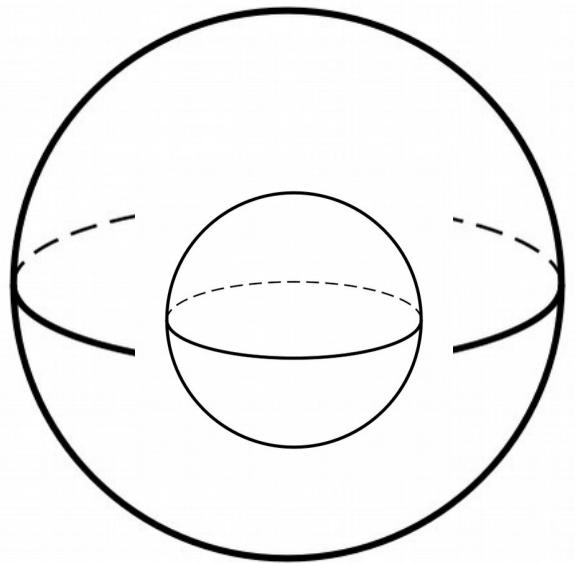
Automated tellers are indeed curious mixes between bank counters and financial strongrooms. Such strongly fortified and CCTV-monitored locations often situate the machine's interface outside the financial office of a bank (figure 59). Still, automated teller machines sometimes have a place inside a banking building (figure 61) or can be located inside booths, offering a self banking service on or off a bank's premises (figure 63). Given this, note how bank customers encounter a kind of container. Suspicious people may temporarily enlarge these enclosures by enfolding their own bodies and things around the automated teller's graphical interface (figure 66).

These machines are often equipped with security technologies to prevent attacks, from vandalism to robbery, while guards may watch over their maintenance and everyday use. Automated tellers are left the rest of their time to their own defence devices. They become assembled with bollards to deter ram-raids: crushing a large vehicle into them to open up their topos; gas suppression systems to avoid plofkraak: exploding the automated teller with a combustible gas, or some other explosive technique; notes neutralisation systems to mark the money in case the enclosure breaks down; audiovisual systems to register deviant activities: tampering the machines to record PIN numbers and cards' information; biometric systems to identify users through body recognition technologies; and encryption systems to scramble transactions over exposable data networks, as well as to offer data protection against hacks or viruses.

**Figure 61.** Safe  
(photograph by author)<sup>135</sup>



**Figure 62.** Sphere on premise



Let's take closer a look at these folds to suggest with their spatial configurations a specification of the machine's fortifications, by distinguishing between bank safes and vaults. Figure 59 displays an enclosure shaped as a vault, a machine attached to the architecture of a building. In contrast, figure 61 pictures a fortification designed as a safe in a security booth: a machine placed inside a building. While figure 59 shows how automated tellers may appear in public places for private use, figure 61 conveys how they can be found also in private places for public use, including stations, pharmacies, universities, etc. In this sense note then how the distinction (between safes and vaults) can be contrasted. Figure 63 shows an automated teller located outside a bank. At first glance it looks shaped like a vault, but the machine is not a constitutive part of the architecture of the building. It may be also looked at as safe that is not located on the premises of the bank. While the walls appear to envelop this automated teller

<sup>135</sup> Taken in Argentina Avenue, Viña del Mar, Chile

machine, they do not quite enfold or protect it completely. Let's call the configuration an unsafe safe.

Unlike in situations such as the assembly of queue lines where people enfold places by aligning the gaps, here people approach strongholds. They touch around their various surfaces, aligning themselves with the passages of access, the gaps cut into these prosaic enclosures. To remain in touch by patting, poking, or nudging around people and things then seems useful for sketching the curves of an apparatus, in order to outline the co-production of action, place, and apparatus. Touching around is a generative gesture I draw with spheres to trace the practical accomplishment of people locating holes, or access passages cut into the folds of fortress-like configurations. Then attuned to a container model of space, useful for reading the practical achievement of enclosures, with spheres I sketch pleats that stabilize the slippery and fragile distinction of being inside or outside concealed places (e.g. supermarkets, cash points) when enfolded by walls. Tori and spheres are *orientable* manifolds, surfaces on which a clockwise rotation may be determined with no topological twists, like Möbius strips, undermining a specification of the sides of the surfaces. These two-dimensional manifolds outline a spatial patterning that delimits the insides and outsides of a topos. In contrast to this reference “if by following some closed loop on a surface, we can change clockwise rotation into anti-clockwise rotation [if a traveller faces the other way around after a loop], we say that the surface is non orientable” (Firby and Gardiner 1991:28). In the next section, I detail twisted loops at the cash point.

**Figure 63.** Unsafe safe  
(photograph by author)<sup>136</sup>



**Figure 64.** Sphere off premise

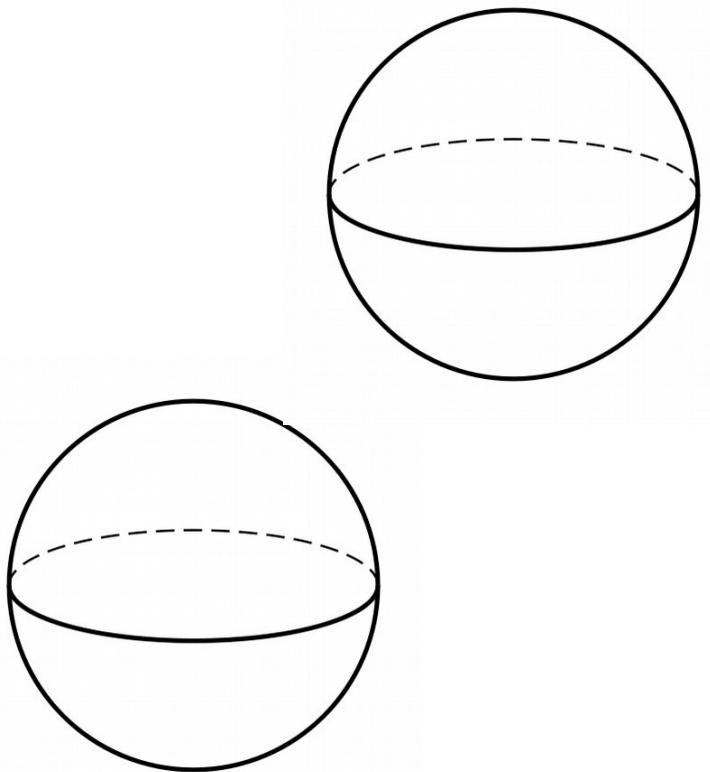


Figure 60 signals with a sphere the lines of a movement, a mode of making and finding passages by contact, by touching around the spatiality of concealed places, in the way people navigate locations of whatever scale with their fingeryeyes, either by creating or eventually bumping into the cuts of the curves of a place, by touching around the passages for steady movement of people and things, the pathways of access stabilizing the flows of daily traffic: translation without mutation. In this way, people may touch around the curves of a city, for example, stretching themselves along an urban landscape, looking out with their fiddling fingeryeyes. In this sense, particular locations may be remembered in the flesh, people may navigate places with less trouble to orient themselves around the walls that enfold houses and buildings.

<sup>136</sup> Taken in Argentina Avenue, Viña del Mar, Chile

Fortifications, like automated tellers shaped as vaults, with spheres may be complemented by drawing a sphere within that sphere, adding a pleat to read automated tellers inside booths or buildings. Then a sphere on premise (figure 62) indicates the fortification of automated tellers shaped as safes, to delineate how people access them by touching around consecutive folds, making iterative distinctions of the insides and outsides of a pleat, aligning the movement around the pleats towards the cash point, stretching a passage of access. In contrast, a sphere off premise (figure 64) underlines the fortifications of automated tellers when shaped with vulnerable folds, to trace how people may bump into unsafe enclosures, appearing to offer less resistance to accessing them by touching around.

Michel Foucault initially distilled from the apparatus curves of visibility and utterance (Deleuze 2007:343). At the cash point, to touch around means to become with the curves of visibility and utterance of automated tellers, appearing ready all the time, open for business, working around the clock, or without closing hours, by delegating to a self service machine particular banking practices. Grasping the folds of places like cash points by touching around eventually requires people to stretch themselves through the passages of access cut into a fortification, to align themselves with a display and a concealment of money, with a machine meshing a bank counter and a强room. Here the machine begins to exercise powers with a personal touch. People are persuaded to collect cash only by typing in their personal data, an enticement configuring the visualization of automated tellers, a silent utterance of light and shadows.<sup>137</sup> I outlined and stressed such contrast throughout this section's figures. In particular, I pictured various fortress-like configurations to sketch some bright and dark spots of automated tellers.

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<sup>137</sup> In figure 63 note my shadow on the door.

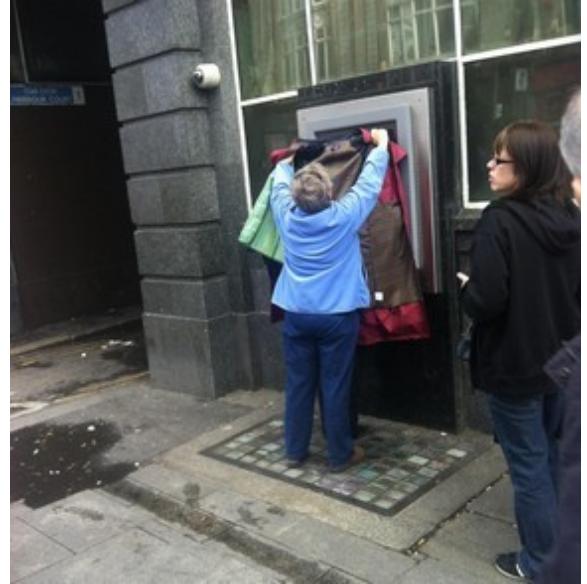
**Figure 65.** Light

(photograph by author)<sup>138</sup>



**Figure 66.** Shadows

(image taken from reddit.com)



People touching around, extending themselves, following the curves of the lines of movement towards a cash point, grasp meandering lines that make visible the variable figures inseparable from an apparatus, the alignment of light and shadows falling over an apparatus, orienting people towards a cash point, pointing their ways into the display and concealment of money. Figure 65 pictures how visualization, the casting of light and shadows, means making something visible:

Visibility does not refer to a general light that would illuminate preexisting objects; it is made up of lines of light that form variable figures inseparable from an apparatus. Each apparatus has its regime of light, the way it falls, softens and spreads, distributing the visible and the invisible, generating or eliminating an object, which cannot exist without it (Deleuze 2007:343).

<sup>138</sup> Taken in Barcelona, Spain.

Then with fingereyes, people stretch a movement around the resistances enfolding enclosures, making and finding ways into the pleats, a movement signalled by the light and shadows falling over this apparatus. In daily life people grasp the bright and dark curves of automated tellers, of self banking services working around the clock, except when their fortifications become inaccessible, as they may be broken or reused (to sleep overnight),<sup>139</sup> scheduling a closing hour, a time out of service. In this sense, the curves of visibility of the automated teller machine shed light upon the multiple practices afforded everyday by these protections. Likewise, shadows can be extended over the machines to obscure the various consequences of these self banking services, that people touch and so inhabit at the cash point everyday.

In other words, to cast light and shadows means to fill up places in collaborative ways. Figure 66 shows one person stretching a jacket over the fortification of an automated teller, enfolding or hiding the user, casting darkness over her actions, enlarging the shadows of this apparatus. In less exaggerated ways, people may fill up cash points by stretching their bodies around the machines, concealing the screens with their shoulders, the keyboards with their fingereyes.

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<sup>139</sup> Taken in 2012, figure 63 captures the aftershock of the economic recession that began in 2007 as a consequence of the housing bubble burst in Spain and the subprime crisis in the United States, attributed to irresponsible taxing and exuberant credit schemes.

## Bottle space

The curves of visibility and utterance which entangle the light and shadows of these machines stretch beyond what is out here: what is made visible and said around a cash point. Intimate alignments entwine what is made present outside the automated teller with what is manifestly absent, or made present in there, inside the machine. Hence what is displayed is connected to what is concealed by the machine, and to what is assembled beyond this place. Furthermore, this alignment of an encounter with automated tellers is rectified by a tangent, connecting cash points with customers' databases, linking them together as networks of the computers of banks. This tangent is a line of force, a line that centralizes around banks the production of individual subjects with particular profiles, a register of exchanges between the insides and outsides of people and machines, during a moment of touching through automated tellers, and a movement of cash articulated by a line in the centre that touches back and affects people.

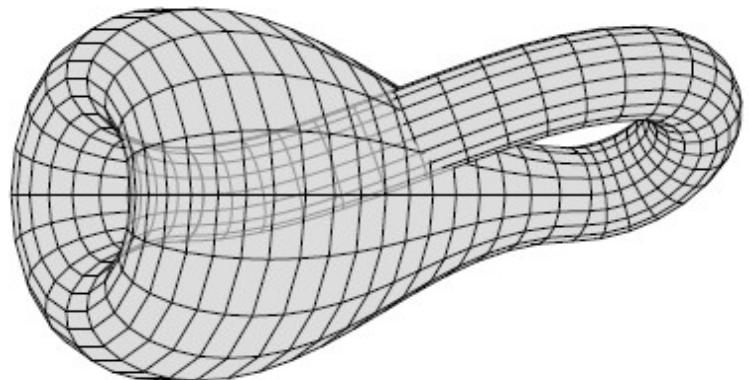
So, touching through and being touched by automated tellers designates an inside and outside exchange at the cash point. Previously, I sketched this moment of movement as an algorithmic dance of the user and the machine through the allegories of an interaction, an allegorithmic time at the point of purchase of supermarkets, a daily passage in which people traverse the distinction between the spaces to collect items, and to move away from the supermarket. This sense of time entails plotting bodily figures with the clocks of machines, speeding calculative processes; a time to compose computations, to articulate metaphors into hardware (Haraway 1998:231-243); a moment to live with algorithms, to flesh them out; a movement of machine time as a “mosaic of relations and ordering of actions brought into proximity” (MacKenzie 2007:89). For this affinity of allegorithmic time there is, I think, a distinctive spatial patterning of insides and outside reversals, that denote in the case of self

checkouts and automated tellers an exchange of what may be inside or outside people and machines, delineated by a loop-and-twist-like tracing of the course of action. This is a moment of reciprocal touch in which users may twist themselves out, or may be detached from, looping through a machinic process such as a purchase or a withdrawal, aligned in a cash point or a purchase point. Reversals can be refigured by folding a plane into a cylinder, then twisting the surface, like a Möbius strip (figure 67), to connect both ends. The result: a Klein Bottle, a topological figure difficult to imagine, impossible to shape without intersecting it in three-dimensional space, a closed two-dimensional manifold created by mathematician Felix Klein. Representations on paper of this twisted figure can allow the surface to intersect with itself, resembling a bottle whose “neck” has been curved, turned up-side down, and connected to the bottom (figure 68).<sup>140</sup>

**Figure 67.** Möbius strip



**Figure 68.** Klein Bottle



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<sup>140</sup> “Since we are doing this in 3-dimensional space, it is necessary to cut the paper to allow part of a non-orientable surface to pass through another part of the surface. In the final model, we pretend such cuts are not there. In fact we have to imagine that the paper model is in four or higher dimensions, where the space model that it represents actually exists. The paper model is a realization of the projection of the space model into three dimensions” (Firby and Gardiner 1991:38).

To touch through automated tellers and to be touched by them is a mundane, fragile achievement, prone to breakdowns, interferences or cuts of the process of exchange of things between the insides and outsides of people and machines. In practice, this reversal of being cashless, this reciprocal touch, often happens without the help of employees. Unlike self checkouts at the supermarket, here they rarely lurk around in case something breaks down or someone gets lost while looping with an automated teller through a cash withdrawal. The exchanging of things by touching through and being touched enacts or gestures towards an adjustment that couples people's bodies, and enfolds practices that matter for making lives accountable. Being in touch with the accounts of particular lives means, in the case of the automated teller, being touched by money through machines touching accounts beyond the cash point.

In this sense, touching through and being touched is a practical endeavour, a reversal accomplished by fingereyes, a mutual enfolding and twisting of people and things through practices articulated by centring the prosaic alignments of bodies, machines, wallets, cards, currencies, etc. Such junctures affect people, as they become attached to a line in the centre touching them back, a tangent entangled to the visibility and utterance of automated tellers, persuading people to approach the machinic cash point, and making impossible for them to withdraw money without disclosing themselves as individual subjects, unless people touch differently or destroy such mutual alignments, embodied as an everyday self service banking practice:

An apparatus contains lines of force. One might say that they move from one single point to another on the previous lines. In a way, they 'rectify' the previous curves [of visibility and utterance], draw tangents, surround the paths from one line to another, operate to-and-fro from seeing to speaking and vice versa, acting like arrows that constantly mix words and

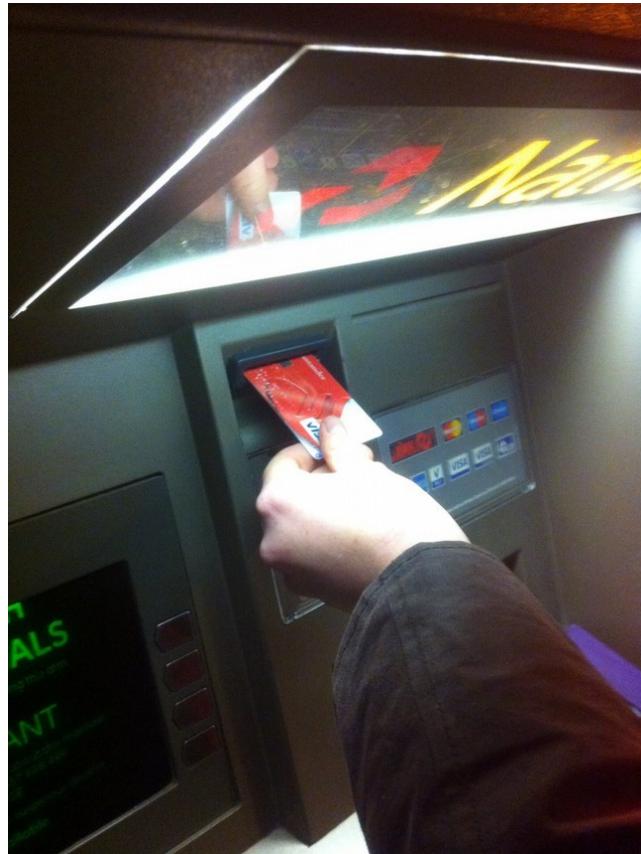
things, without ceasing to carry out their battles. A line of force is produced in every relationship between one point and another and moves through every place in an apparatus. [...] It is the dimension of power (Deleuze 2007:344).

The dimension of power of the line in the centre of automated tellers becomes subtly embodied and enlivened through the brief gestures of people. Resonating once again with the fortification of pukaras, people passing through automated tellers are screened by making a generative, relational, agential cut between what is made visible and said, and what is made invisible and left unsaid. This rectification connects in strategic ways what is made present, manifestly absent, and Othered. Under the foldings of the automated teller's line in the centre reversals may happen, people indeed get cash from the machine, what was once inside the automated teller may be made present outside. This is done strictly under secured procedures, configuring how and for whom particular economies may flourish, through computing and screening moments of movement, in places designed to prolong the circulation of specific currencies. Then grasping the line in the centre becomes everyday business, by facing automated tellers.

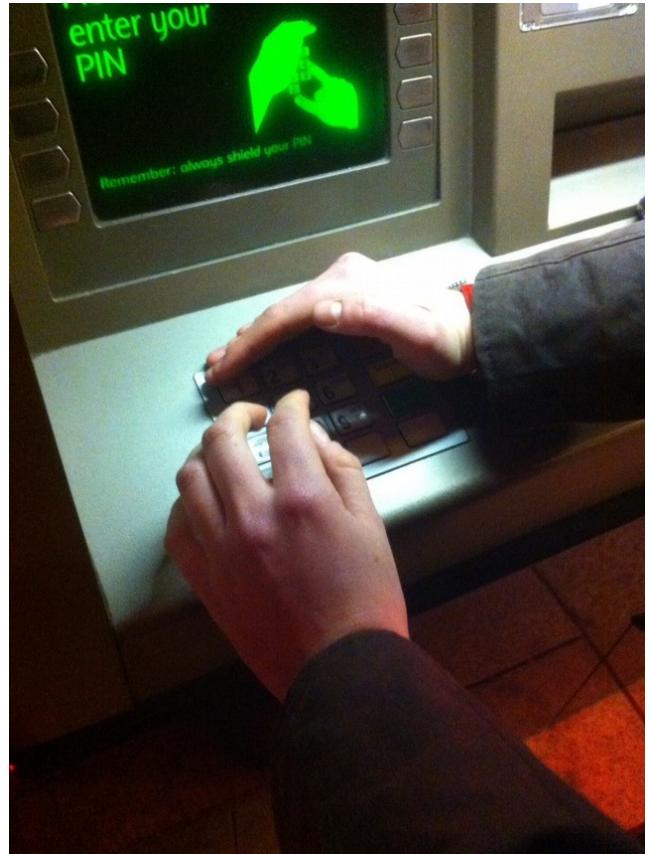
Immutably waiting in place, people attracted daily into these envelopments become immobilized for a moment in front of the machine, where the menu patterns displayed by a computer screen take hold of them. Since interactions with automated tellers begin with fingereyes, things stored inside containers (such as wallets, purses, backpacks, handbags, notecases, etc.) may be unfolded to look for debit and credit cards. Then sliding these banking devices through the access-slots of automated tellers (figure 69), people present themselves to the machines as individual subjects by entering a PIN number (figure 70). Interestingly, this does not matter yet. If you type any four digit number at a cash point the automated teller will display the

self service menu patterns for you. In other words, exchanges concern so far what is made present out here (at the cash point) and what is made manifestly absent in there (inside the machine), as no exit passage has been made for things to travel beyond this place. In practice, it is only after the fulfilment of a self banking service procedure, when a user has already faced the machine, pressed the buttons, and located on the display (figure 71) the steps to handle the withdrawal of cash without interruptions, that exit passages for the money, the data, and the user are created that allow them to move away from the automated teller (figures 72-73). It is here and in this way that a line in the centre powerfully designates what counts as desirable banking and for whom; as well as who is authorized to (re)configure lawfully the exchanges of currencies for information, when people and machines meet.

**Figure 69.** Inserting a card  
(photograph by author)



**Figure 70.** Entering a PIN number  
(photograph by author)



**Figure 71.** Facing the ATM<sup>141</sup>  
(photograph by author)



**Figure 72.** Getting cash  
(photograph by author)



**Figure 73.** Moving away  
(photograph by author)



In short, a line of force enfolds the cash point, opening up exit passages for a line of subjectification: for the disclosure, profiling, aggregation, and centralization of well known, profitable customers around banks. Still, the production of particular individuals crosses over, escapes, breaks away from the circumscription of the line of force of an apparatus. Not every apparatus has it. For Deleuze this line has surplus value (2007:345) or a dimension of the self through which people become authorized to process particular selves, by passing through an apparatus:

This going beyond the line of force is what happens when it bends back, starts meandering, goes underground, or rather when force, instead of entering into a linear relationship with another force, turns back on itself, acts on itself or affects itself. [...] The Self is not knowledge or power. It is a process of individuation that effects groups or people and eludes

<sup>141</sup> I thank my friend Jess Phoenix for enacting a self banking service at the cash point.

established lines of force and constituted knowledge (Deleuze 2007:345).

The line of subjectification of the automated teller may be confused with the (ab)use of forces and knowledges as resources of power. When these machines are assaulted, when the automated teller's line in the centre gets confronted or destroyed by those refusing to identify themselves as distinct individuals; when people add pleats to hack the process and collect information to commit card fraud; when they attack and explode the fortifications of these machines; when they break down these folds and flee with the money; then people are not attempting to escape the powers of this place. Rather, they are tied up and defined by them as unlawful subjects wishing to get money in undesirable ways. They are pursued and if caught violently touched back. To make a careful move sideways here what is needed is a better understanding of the sociotechnical ways in which the line of subjectification of the automated teller may be performed by way of creation of alternatives, to responsibly devise actions to touch one another differently.

## **Projective space**

Living with currencies, making a payment, trading off money for goods and services, exchanging information for cash, following Karen Barad, are all intra-actions; not pre-given possessables but performative processes, not interactions timed in advance but matters of intra-action.<sup>142</sup> These matters put money in circulation, subjected to accountable iterations which, of course, may be decided upon by talking about the powers of the economies articulated with monetary currencies, and the assemblages of political, economical, and legal institutions that support them. In short, economies and currencies are always co-produced by specific agential apparatuses:

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<sup>142</sup> See chapter 5.

Agency is doing/being in its intra-activity. It is the enactment of iterative changes to particular practices – iterative reconfigurings of topological manifolds of spacetime matter relations – through the dynamics of intra-activity. Agency is about changing possibilities of change entailed in reconfiguring material-discursive apparatuses of bodily production, including the boundary articulations and exclusions that are marked by those practices in the enactments of a causal structure (Barad 2007:235).

With closed two-dimensional manifolds, with tori, spheres, and Klein bottles, it is this understanding of agency and change, as a topological reconfiguration of relations that matter in space and time, that I think can be sketched around, through, and away from an apparatus. Computer screens enveloped in self service machines are for me important examples of this assembling and devising task. But the question remains: how to move sideways into spaces of freedom and *jouissance*? How to design allegorical intra-actions for becoming response-able when people and machines touch one another? How might their animations and automations (Stacey and Suchman 2012) retell stories, reshape figures, and rebuild passages for circulating currencies? Exploring the proposition of sketching with surface topology, projective planes<sup>143</sup> appear at last immanently appealing for staying with the trouble of living with money while moving parallel to banks.

The name of this manifold comes from stretching parallel lines that meet at one point at most. Imagine a plane refigured as a sphere whose whole surface self-intersects, continuously looping inside out. Thus like the Klein bottle the projective plane is a non-orientable manifold,

<sup>143</sup> “The development of painters of the system of focused perspective led to the growth of a new form of geometry, called projective geometry. [...] In Euclidean plane geometry, parallel lines never meet, while in the new projective geometry, in accordance with what we see, every pair of lines meet. If we stand between railway lines, we see that they meet at a point on the horizon, so we include this point in our new plane geometry. By doing this for parallel lines in *all* directions, the *whole* of the horizon is included in our new geometry” (Firby and Gardiner 1991:41-42, *italics in original*).

which features in the Klein Manifesto of 1872, the Erlangen program, that sorted the growing invention of non-Euclidean geometries as particular cases of the projective plane.<sup>144</sup> With this manifold allowing for parallel lines to meet with each other, I sketch how parallel lives may interfere with one another on a horizon articulated by machines passing currencies that work without banks. And these wicked species,<sup>145</sup> circulating around and away from the institutional frameworks that affect people daily, open up passages for the transaction of new kinds of currencies. With the projective plane, I move sideways into the modest rise and falls of cryptocurrencies.

Along with a second report commissioned once again to Value Partners consultants, the industry association of automated tellers (ATMIA) released a position paper<sup>146</sup> during 2014 on Bitcoin, one of the most prominent crypto-currencies circulating without the governance and securitization of entities like the International Monetary Fund, the World Bank, or any central government or bank traditionally in charge of steering, policing, and backing up the financial planification of currencies such as Pounds, Euros, Dollars, Yens, Pesos or any other people's currencies. ATMIA's publication highlights that Bitcoin would not be "a threat to cash or to established electronic payment methods but [ATMIA] recommends increased support and supervision of BitCoin ATMs to ensure they abide by security best practices & maintain the industry's current levels of consumer trust" (2014:1). The paper values Bitcoin as a "creative destruction [...] A disruptive new innovation in the sense that it creates a different model of

<sup>144</sup> Euclid defined his flat geometry by resorting to five axioms including the parallel postulate: parallel lines never meet. "In the first half of the nineteenth century there had been several developments complicating the picture. Mathematical applications required geometry of four or more dimensions; the close scrutiny of the foundations of the traditional Euclidean geometry had revealed the independence of the parallel postulate from the others, and non-Euclidean geometry had been born" (Wikipedia's Erlangen Program entry retrieved from [http://en.wikipedia.org/wiki/Erlangen\\_program](http://en.wikipedia.org/wiki/Erlangen_program) last accessed 26/06/2016).

<sup>145</sup> The etymology of the word species refracts into multiple directions (see chapter 4). Species can be a type or kind of thing; a mental impression, an idea; a group of plants or animals having similar appearance; a rank in the classification of organisms; the image of something cast on a surface, or reflected from a surface, or refracted through a lens or telescope; a visible or perceptible presentation; an appearance; something perceived; a coin, or coined silver, gold, or other metal, used as a circulating medium. Here I use it to designate a coin.

<sup>146</sup> <http://goo.gl/b3s71o> (last accessed 19/02/215)

payment and a new global, decentralized digital currency, challenging some fundamental assumptions of established payment methods and governance of currency” (2014:1-2). Bitcoin notably thrives on networks of computing devices to mint (create), afford, and regulate a generalized medium of monetary exchanges based on the algorithmic configuration of a currency with a public ledger. Bitcoin's method to account for financial exchanges is referred to as a Blockchain technology.<sup>147</sup>

Bitcoin's payment system was created by Satoshi Nakamoto in 2008,<sup>148</sup> allegedly as a response to the political and economical bailout of international banks, in the context of their irresponsible behaviour related to credit markets for financing the housing sector in the United States and elsewhere. The crypto-currency, like others that copied or modified its innovative schemes, translates the role of banks by designing software to produce a currency under a determined provision of coins, a programmed growth of the currency, to strategically tackle inflation as well as peer to peer payments.<sup>149</sup> In this way online payments become irreversible: people need to “trust computers alone with their money”. One asks a bank to reverse a payment online if a good bought from a vendor through Amazon, for example, turns out to be a scam. Bitcoin does not allow that because the chain of events, the Blockchain, once actualized, cannot

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<sup>147</sup> “Until now [most] monetary systems have been built on centralized ledger-keeping [...] The problem has always been that this model confers too much power and excessive profit on those central record-keepers [...] Bitcoin's blockchain ledger is a long chain of blocks, or groupings, of transactions occurring around the same time. The chain will continue to grow indefinitely [like queues] so long as the system keeps operating. This chronological structure is crucial because it confers legitimacy [trust] in the oldest transactions, the idea being that later-dated attempts by a user to re-spend the same bitcoin balance is treated as illegitimate. By creating a time-stamped sequence of expenditures and receipts among every participant in the bitcoin economy, the system keeps track of where everybody's balances are at any given moment, as well as identifying information attached to every bitcoin – and fraction of bitcoin – ever created, spent, or received” (Vigna & Casey 2015:120-123).

<sup>148</sup> A mysterious character believed to be a pseudonym for a person or a group. After publishing the description of Bitcoin's transactions, timestamp servers, proof-of-work, networks, incentives, verifications, privacy, etc., Nakamoto made a few more appearances online and then vanished. Different identities have been suggested, all unconfirmed.

<sup>149</sup> “Commerce on the Internet has come to rely almost exclusively on financial institutions serving as trusted third parties to process electronic payments. While the system works well enough for most transactions, it still suffers from the inherent weaknesses of the trust based model. Completely non-reversible transactions are not really possible, since financial institutions cannot avoid mediating disputes [...] These costs and payment uncertainties can be avoided in person by using physical currency, but no mechanism exists to make payments over a communications channel without a trusted party” (Nakamoto 2008:1).

change in order to avoid the problem of double spending electronic money, as coins may be duplicated when configured digitally, just like copying a folder. “We propose a solution to the double-spending problem using a peer-to-peer distributed timestamp server to generate computational proof of the chronological order of transactions. The system is secure as long as honest nodes collectively control more CPU power than any cooperating group of attacker nodes” (Nakamoto 2008:1). From here on the technicalities of Bitcoin multiply. Let me provide a description of a transaction<sup>150</sup> and discuss the promises and troubles of crypto-currencies like Bitcoin.

A digital wallet to store, send and receive bitcoins is the equivalent of a bank account.<sup>151</sup> Wallets come in flavours: software and web based. In the latter people trust their electronic payments to a third party. To acquire bitcoins it is possible to simply run Bitcoin software and provide computing power to collaborate in the system of transactions. People can help minting coins by solving Bitcoin's algorithmic puzzles, a practice allegorically named mining, thus resonating with extracting metals as resources to make coins.<sup>152</sup> These computing puzzles, on average, are solved every ten minutes. The difficulty increases as more people and machines collaborate, which keeps Bitcoin growing steadily.<sup>153</sup> The ceiling is fixed: 21 million coins are expected to be minted by 2140. Computers are paid in bitcoins when they solve puzzles, thus

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<sup>150</sup> “We define an electronic coin as a chain of digital signatures. Each owner transfers the coin to the next by digitally signing a hash of the previous transaction and the public key of the next owner and adding these to the end of the coin [...] To accomplish this without a trusted party, transactions must be publicly announced, and we need a system for participants to agree on a single history of the order in which they were received. The payee needs proof that at the time of each transaction, the majority of nodes agreed it was the first received” (Nakamoto 2008:2). In short, Bitcoin's economy builds *ad hoc* politics.

<sup>151</sup> “Sending bitcoins is as easy as copying and pasting someone else's address, choosing an amount, and clicking send. [...] Essentially, sending a bitcoin is a lot like sending an email. You put in someone else's address and there's no going back after you hit send” (Bitcoinsimplified Website retrieved from <http://bitcoinsimplified.org/get-started/how-to-use-bitcoins>).

<sup>152</sup> “Miners keep the block chain consistent, complete, and unalterable by repeatedly verifying and collecting newly broadcast transactions into a new group of transactions called a *block*. A new block contains information that 'chains' it to the previous block [...] A new block must also contain a so-called *proof-of-work* [evidence of solved puzzles]” (Wikipedia's Bitcoin entry retrieved from <http://en.wikipedia.org/wiki/Bitcoin>).

<sup>153</sup> <http://blockchain.info/charts> graphs the Bitcoin economy: number coins and transactions, market capitalizations, etc.

around this practice miners organize themselves in computer “pools” or “farms” to collaborate. Another way to get bitcoins is by running and helping the system to check attempts at double spendings and other attacks. A third way is to exchange other (crypto) currencies for bitcoins. People can, of course, offer goods and services, including their labour power, in exchange for bitcoins.

**Figure 74.** Lamassu ATM

(image taken from lamassu.is)



**Figure 75.** Robocoin ATM

(image taken from coinatmradar.com)



“The key innovation of [these] digital currencies is the ‘distributed ledger’ which allows a payment system to operate in an entirely decentralised way” (Ali 2014:1). But decentralising a currency is not without problems in practice. In contrast to the ethnographic difficulties of approaching automated tellers in locations with high surveillance, where taking a photo or approaching a person at the cash point already looks like a robbery, to study crypto-currencies means to be subjected to a modified regime of individuation. What public ledgers such as the Blockchain register are IP addresses or locations of computers, but to establish a connection

between distinct people and specific IPs is a layer that monetary systems based on crypto-currencies do not comply with. While providing a degree of anonymity, this feature allows economies to function in bewildering ways, prone to controversies. Then experts on crypto-currencies point out their troubles: deflationary spirals due to hoarding, forking of the public ledgers, delayed transactions, digital attacks to wallets and exchange services, lack of legal or financial support from central banks and governments, affordance of money laundering, black markets, selfish or speculative use, etc.<sup>154</sup> And perhaps the cruellest attack on Bitcoin is not to consider it as a currency at all; at best as an economic asset, when compared to a bona fide currency.<sup>155</sup>

On the other hand, experts in, and users of, crypto-currencies count their sometimes unexpected benefits: a public account for economic exchanges, a predictable supply of money, a new way of building trust, a method to send cash around the world at low cost, a “practical materialism”, a cause of reduction of violence in drug markets, etc.<sup>156</sup> In any case, services thriving on crypto-currencies abound, either because they are taken as a profitable business, or as ways of combining fun and software as they may “bind the psychic energy of programmers into certain forms of movement, feelings of potency and somewhat aggressive and eroticized attachments” (MacKenzie 2014:129). Among the growing list of services for these curious new currencies, automated tellers machines to buy cash (withdraw) in exchange for currencies (without disclosure of personal data) multiply: Robocoin, Bitaccess, Bitcoin ATM, Lamassu, etc.<sup>157</sup>

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<sup>154</sup> Ali 2014; Barber et al. 2012; Ben-Sasson et al. 2014; Biryukov & Pustogarov 2014; Elwell et al. 2015; European Central Bank 2015; FBI 2012; Koss & Koss 2012; Maurer et al. 2013; Nakamoto 2008.

<sup>155</sup> “A bona fide currency functions as a medium of exchange, a store of value, and a unit of account, but bitcoin largely fails to satisfy these criteria. Bitcoin has achieved only scant consumer transaction volume, with an average well below one daily transaction for the few merchants who accept it [...] Bitcoin's daily exchange rates exhibit virtually zero correlation with widely used currencies and with gold, making bitcoin useless for risk management and exceedingly difficult for its owners to hedge. Bitcoin prices of consumer goods require many decimal places with leading zeros, which is disconcerting to retail market participants” (Yermack 2014:1).

<sup>156</sup> Aldridge & Décaray-Hétu 2014; Ali 2014; Barber et al. 2012; Ben-Sasson et al. 2014; Elwell et al. 2015; Koss & Koss 2012; Maurer et al. 2013; Nakamoto 2008.

<sup>157</sup> <http://www.coindesk.com/bitcoin-atm-map/> lists and maps these automated tellers available in different locations.

## Coda

In these discussions, cutting money to knot economies in a new cryptographic way appears to produce bewildering effects. In my view, it seems that the consequences of crypto-currencies like Bitcoin create everyday places of resistance to the persuasions of the line in the centre. Places of resistance are co-produced through the timings and spacings of bodies and apparatuses; they entail a kind of positioning, a move sideways. People in places of resistance pursue lines of subjectification, as “the extreme edge of an apparatus [insofar] they trace the passage from one apparatus to another: in this sense, they would prepare for lines of fracture” (Deleuze 2007:348).

ATMs passing crypto currencies do not prepare for lines of fracture by default. Lines of fracture are made in specific histories and practices and by changing dynamics of change through iterative reconfigurations. Such dynamics might be grasped as a projective horizon, a topology where parallel lives meet and become accountable for their constitutional exclusions. It is a matter of shifting the possibilities of in/determination of causal structures in a particular situation with specific costs. This may facilitate an escape to break away from the rectifying capacity of the automated teller's line in the centre. Interestingly, this seems an effect of meshing people and crypto-currencies with digital wallets. For instance if wallets are assaulted or accidentally lost, people witness the destructive creation of zombie coins: a bitcoin that indeed appears in the Blockchain but may not be passed around. It is effectively excluded from circulation. This odd situation is similar to finding a coin that is stuck in the pavement, one may grasp it but not pick it up. This is what I find very interesting about automated tellers passing around Bitcoin or other equivalent crypto-currencies. In particular, what I think is fascinating is the possibility of non coherent economies. Because automated tellers passing crypto-currencies are designed to leave indeterminate (i.e. trouble) the disclosure of people (their ages, genders, etc.) in economic exchanges, the bewildering situations and controversial effects of these apparatuses may be

understood as opening up non coherent economies assembled through the circulation of these tokens. This possibility implies that Bitcoin economies, like any other, do not produce totally coherent accounts – or rather the actors participating in their assemblages ontologically shift around, sometimes acting coherently, sometimes not. In my view, this is why critics of these economies have trouble in valuing their effects seriously. Bitcoin does not fit their theoretical assumptions of what a currency is, as many of them seem to have forgotten that *oikonomias* are mundane.

In other words, the Bitcoin economy seems to resist being concealed conceptually and practically in known, traditional ways. It mutates, so to speak, between mobile and immobile positions. Bitcoin discloses the multiplicity of currencies (tokens) as mutable immobiles and mutable mobiles. To say it with surface topology: to open up passages through the cracks and fissures that crypto-currencies help to delineate, people can learn to move sideways into the temporal and spatial patterning that I figured here as tori, spheres, Klein bottles, and projective plane. In this sense, the creation of spaces of freedom and *jouissance* is not unlimited but conditioned to the shifting gears of apparatuses, to their agential cuts, exclusions and potentials, opening up new ways of affecting one another through touch, and of aligning our selves with devices.

## **Chapter 8. Exit Passage**

In this study of screens and screening devices, we began by moving sideways from seeing screens as displays. In chapter 1 I observed that screens, on the one hand, bring something into view. I called the “display” that which screens make visible. The display of a screen, on the other hand, always leaves something else out of sight. This sense of screen includes then, but is not limited to, the notion of display. What a screen brings into view and what is left out of sight can be considered as an effect of an alignment of people and things with a display, which at once reveals and conceals in a specific situation. Frames in this conceptualisation are the material enclosures of the display. A frame attracts the attention of the viewers of a display, and bounds or limits what the screen's display makes visible. So I distinguish between screens and displays, and include the latter in the former: displays are parts of screens that cut off particular views and viewers. This distinction of screen and display makes a place for divisions and concealments, which are also a part of screens.

Studying alignments of people and things with displays guided my analysis of what screens conceal. By enacting alignments, I approached screens and noted how people and things become located in relation to displays and their concealments. Aligning screens takes place in prosaic situations. In chapter 2, with Ingold (2007), I explored lines as figures, in order to approach screens as alignments of everyday matters. I did an exploration of lines on the road, on a pedestrian and bicycle pathway to Lancaster University. Following Haraway (1991), lines are material-semiotic actors; with them I unpacked the markings on the road's surfaces. Lines are excellent figures with which to grasp how surfaces are threaded, and how screens are made out of surfaces and/or gaps. Taking as an example the line in the centre of the pathway, I considered how it aligns people and

things. It sorts them out along the road in order to arrange their pathways across the land. The line in the centre became a figure to indicate how sorting out or screening people and things can be tied to centres of calculation (Latour 1987) and coordination (Suchman 2011).

In chapter 3, I asked what happens when people cannot turn away from the display of screens. An occulo-centric embodiment frames screens as (digital) surface and so reduces the alignment of screens to their displays; this has consequences, particularly for screens that try to leave nothing out of sight, to reach and “augment” everything. We imagined the viewers that emerge in such cases with Google Glass and its promotional video “One Day”. The fictional observer of these “smartglasses” featured in the ad enacted for us how the device would smoothly configure the world for a “user” who never needs to take his glasses off. Following someone we never got to see, we circulated effortlessly around a city “augmented” by Glass. Nothing appeared to escape our capacity to visualize “useful information,” to resolve or avoid problems in advance. Then we discussed how this story hides what the screen of Google Glass leaves out of sight. We contrasted “One Day” with a YouTube parody that mocks the alleged benefits of Glass. In this version, wearing the glasses at all times made visible the contingent outcomes of matching locations with layers of data. Exaggerating how actual situations may interrupt expectations, Glass's transparency was called into question, and shattered by the breakdown of actions.

These breakdowns disclosed blind spots that allowed us to see how Glass configures people as users. Moving sideways from see-through digital surfaces like the display of Glass is hard; one has to let go for a moment of what the display makes visible. But putting Glass away seemed not enough to respond to Google's business – based as it is on extracting user data for a profit (Fuchs 2012). One can stay in touch with Glass when the display is off and thus remain attached to centres of calculation and coordination that exploit the unpaid work of people who provide their data. That

is a tricky line in the centre. Perhaps moving sideways from Google database services entails, instead, shaking off the figuration of users as humans “augmenting” reality. In this sense, we speculated with Emma how to step out from the human-machine configuration (Suchman 2007) of screens. I began to see through as well as to look around and away from the screen's display. This is what I call juggling with screens: letting go of what they show to momentarily grasp what they hide, by paying attention to what is around, through, and away from their displays. Grappling with screens in this way helps to avoid reducing them to displays or surfaces.

Emma's curiosity suggested that we might learn from dogs how to move sideways from figuring screens as displays made only for humans. In chapter 4 we did this by training with Medical Detection Dogs (MDD). Training is a canonical activity of Haraway's “contact zones” (2008:205), where species “become with” one another. Threaded together in partnerships, in multi-layered practices or gestures, species texture the web of relations that brings them into being. Human trainers in contact zones with dogs learn to recognize the cues of authority of their canine companions. That is the case in agility, biodetection, and care practices. Learning in this way allowed us to understand in the contact zone how screens and screening practices make sense with/for dogs. We focused on the courses of action crafted by training in collaboration with biodetection dogs (Lucy and Daisy). In these circuits or passages, aligned by the practices of detecting cancer samples and sending alarm messages, what counted as screen and screening practice (what Lucy, Daisy, Rob, and Lydia made visible and hid from each other, what they displayed and concealed) took place around, through, and away from the sample and the alarm system.

We saw that this process does not revolve around one partner. It is not centred on the humans, the dogs, or the samples. Instead, the screening of cancer required the distribution of

samples in a carousel or a line of stands. And by teaching a biodetection dog like Daisy to go around, through, and away from such devices, the dog, the human, and the sample became all caught up in the web of relations that brought the presence/absence of cancer into view. This entangled way of working and playing at MDD allowed dogs to become screens for humans. Enjoying this non-invasive way of detecting the disease, Daisy screened the samples with/out cancer. But dogs cannot say with human words how they do it, they remain silent about their doggish ways. That opened up the question of the place of the nonhuman animal in scientific laboratories.

For this debate I blended ethnography with animal studies and geographies (Wolch and Emel 1995, Philo and Wilbert 2000), to argue that dogs may be good lab assistants. They can collaborate by bonding with humans and thus performing jobs as partners rather than as test subjects. In this sense I moved sideways with the task of dogs at MDD and unravelled the moments of movement around, through, and away from the carousel and the stands. This put together the affects and creativities of the partners, and textured the relations through which they became significant for one another. I detailed such textures with Law and Lien's notion of architextures (2013), and talked about another case of conjoined practice with dogs at MDD: a design of Animal-Computer Interaction which I borrowed from Charlotte's canine alarm system. This prototype illustrated with Lucy how the choreography, or the patchwork of moments of movement through which Lucy expressed her care for Lydia, meandered around, through, and away from the tuggy-toy. And again we read that path as made in a web of relations without a centre.

The lines, surfaces, and textures from chapters 2, 3, and 4 helped me to study screens as alignments of gaps and/or surfaces, that arrange or architexture encounters of people and things with the display of screens. In chapter 5 with Vig and Ben I folded such textures in order to outline

the limits of what they can display and conceal. I traced how grasping what Vig and Ben made visible entails touching and being touched by their displays. In this sense I outlined two modes of touching. On the one hand, I described how writing with Vig helped me to unfold my workplace, as a passage assembled around and through its display. I drew the limits of my workplace with Vig in my shared office. On the other hand, I observed how unravelling my workplace with Ben required enfolding its display within wider arrangements. I tracked with Ben the ways in which my workplace touched me back. Both complementary ways of touching articulated how Vig, Ben, and I took a place in and out of my workplace, seen as a practical enactment rather than as a fixed space.

With Vig, I articulated the idea of folds as the unravelling of a web of relations, or an unfolding of my workplace. With Ben I considered how this web of relations is enveloped in wider arrangements, or enfolded in a hinterland. By un/en/folding, I grappled with what displays bring into view/leave out of sight. Pleating displays and their concealments, Vig and Ben allowed me to un/en/fold an account of my embodiment of these screens and of the materiality of their screenness. As argued initially with Knorr-Cetina and Bruegger (2000, 2002) grasping the way in which actions like trading and writing take place through the display discloses how people and things on screen come into being. Spaces “in between” screens are embodied; and what appears on screen gains, through observation and manipulation of the display, material and tangible features (Myers 2008:178). I expanded this insight with Vig in order to think through how my embodiment and the materiality of this screen are aligned, by articulating a relational web that partly includes what goes on around the display. Extending this point, I suggested with Ben that what is excluded from this approach may be concealed from view and can appear away from the display, while remaining necessary for the screen.

Moving sideways is an approach to grasping screens that starts around rather than in front of them. This simple consideration is key to understanding how screens take a place in everyday life. Screens are always somewhere. I have condensed the contributions of this approach to screens in the set of figures introduced in these chapters. Lines helped us first to differentiate between screens and displays. With lines I considered how screens overflow the frames of their displays, insofar as screens not only bring something into view but also leave other things out of sight. I used the term ‘alignment’ in order to stress how to engage with screens is to become aligned with displays that partially blind the observer/user. Alignment designates frames as a limit of the display; that is, a material enclosure of what screens make visible. Frames matter for screens when one acts through the display; around and away from displays, the boundaries of screens are outlined by what they leave out of sight in a specific location. In this way I tried to resist concentrating our attention on displays while looking at screens.

Surfaces further allowed me to think about screens as displays with blind spots. Seeing screens only as displays configures them as surfaces that, taken to the extreme case of Google Glass, leave no gaps and spaces in which to look away from the display and to juggle with or realign the screen. Missing what screens leave out of sight interferes with people's experience of what goes on through their displays. Taking blind spots into account helps to approach screens sideways, in order to resist the extraction of values (specially valuable data) as an intrinsic element of the encounter.

The figure of textures underlined the gaps and/or surfaces of screens in the alignment of people and things. Textures are the qualities of a relation. By examining textures with Medical Detection Dogs we learned to relate to people and things as companions or partners made in practice. Textures choreographed in alignments foreground the situatedness of becoming with a

screen. On the one hand, the lessons of screening with dogs helped me to appreciate the gaps and/or surfaces of screens in the array of cancer samples and the design of Charlotte's canine alarm system. On the other, what counted as a screen, for whom screens were made, and what was screened out, became a matter of moving around, through, and away from the samples and the alarm system. With textures I tried to grasp screens without centring my attention on a single surface. Screens in practice can be shape-shifters, "not particularly stable because different practices do them in different ways" (Law and Lien 2013:5).<sup>158</sup> They change according to the variable geometry that enfolds the places in which people and things unfold their relations with screens.

I used the figure of the fold as a trope to approach how screens take place in concrete locations. According to Bowker (2010), folds are about staying in touch with the insides and outsides, or the boundaries, of people and things. Thinking about folds suggests methods to grapple with the twofold act of screens, or the un/en/folding of the screenness of screens, what they display and conceal, what they make present, manifestly absent, and Other. I developed this idea with the notions of method assemblage (Law 2004) and apparatus of bodily production (Haraway 1991, Barad 2007), considered through Myer's body-work (2008) and Hayward's fingereyes (2010), as two ways of touching, of becoming in touch with what screens bring into view and leave out of sight.

Knots and cuts are figures that helped me to study specific locations in which screens un/en/fold alignments of people and things with displays. Self checkouts and automated tellers served as examples of locations (the supermarket and the cash point) in which screens align shopping and banking activities that go around, through, and away from the display of these machines. I used the expression moment of movement to draw attention to the duration in time, or

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<sup>158</sup> Law and Lien looked at human-salmon relations to make this argument. I have tried to apply the point to screens in human-dog relations.

timing, and the extension in space, or spacing, of their approaches to screens. Knots helped us to detail how the duration of the purchase rests upon the moments of calculation that move people and things in a supermarket. Cuts helped us to detail how the extension of the withdrawal of money from the ATM rests upon the flows of money going through people and things, in and out of banks. In this sense knotting and cutting screens emphasized what they cut off from view, in a specific location (Winthereik, Lutz, Suchman & Verran 2011:1).

Stretching or reaching into folds defines the duration and extension of the moments of movement around, through, and away from the display of screens. In this way I approached in chapters 6 and 7 the screens of self checkouts and automated tellers. In chapter 6 I read the unfoldings of screens during supermarket purchases, and stressed with knots how understanding the calculation of self service practices requires grasping their inclusion of people and things acting around and through the display of self checkout machines. Focusing on the alignments unfolded by the screens of self checkouts in supermarkets, I accompanied my friends Marina and Liviu who enacted a purchase for me, a passage that zigzagged around the aisles, through a self checkout machine, and away from the shopping floor. I followed their commitment to the purchase in the making of knots or attachments to the supermarket, by doing face-to-basket and face-to-shelf alignments. And I highlighted such knotting with the khipu, as a figure that brings the supermarket into view. Khipus (a mnemonic Inka device) are a reminder of how telling shopping stories with knots creates an account of purchases as calculative practices. Callon and Muniesa (2005) provided insights with which to think about market calculations, and their relation to supermarket self checkouts, as algorithmic configurations of collective devices, a pragmatic approach to market agencies. Since actors and trade in supermarkets are path-dependent features, or outcomes of making activities economic, I explored how self checkouts help to display configurations of supermarkets and shoppers. For this task, I unpacked the purchase of Marina and Liviu and composed an open-ended list of moments of movement around, through, and away from the

purchase point. From Bakthin (1981) I borrowed his sense of chronotope to examine the stretchings or durations of such moments. By proposing a conjunction of space and time, the chronotope is a trope that knots in practice the duration of a moment, with the extension of a movement.

Equipped with these insights, I considered how the time to pay is delayed during the purchase in a supermarket. I traced this configuration of supermarkets through the history of self service practices, making sense of the self checkout as a money machine knotted into this history, which became situated at the purchase point as a boundary of the shopping floor. Such a configuration arranges the shopping floor around predefined opening and closing times, and so invites people to become shoppers who qualculate (Cochoy 2008) or evaluate and choose items without immediately paying for them. Qualculation is the calculative practice of the supermarket made visible on the shopping floor. The practice is tied to the self checkout by the shopping basket (which offer less qualculative space than the shopping cart, but is permitted in the self checkout zone). I registered a second calculative practice, a mutual adjustment or calqulation (Cochoy 2008) of movements arranged by people and things, in order to reciprocally adjust their positions while queuing. By making calqulations, people in queues are screened from those people shopping or doing qualculations on the shopping floor. The queues may be seen as a different chronotope than the shopping floor; queues signal the duration of a waiting time that supermarkets can anticipate and structure, but people may also align themselves into queues with unpredictable shapes.

Queues stretching towards self checkout machines are entangled in the chronotope of the purchase point, where the calculation of items takes place as an “express” self service practice. We observed, however, how employees assist the purchase when shoppers have trouble dancing with the machines, and noted how often employees put the machines out of service in order to extract their cash. Supermarkets profit from people using self checkouts by recording their purchases,

profiling their preferences, and translating shoppers into well known customers. I followed Marina and Liviu out of the supermarket, tracking the chronotopes that they unfolded around, through, and away from the purchase point, a passage enfolded in the collective device called supermarket. This path, tying shopping floors, queues, purchase points, and exit passages (four moments of movement of supermarkets, knotted or configured to calculate profit margins and coordinate purchases), may be further reconfigured on screen, by aligning shopping floors as websites, queues as deliveries, and purchases as online payments, making it easier still to register people as customers.

In chapter 7 I examined the enfoldings of screens during cash withdrawals, and emphasized with cuts how grasping the fortification of banking services with automated tellers requires recognising their exclusion of those acting away from the display, but who remain necessary in order for bank clients to get their cash from the machine. Pinpointing the enfoldings of the alignments unfolded by the screens of automated tellers, I followed my friend Jess who made a cash withdrawal in a square, along a passage enfolded by a queue, beside a building nearby to an automated teller, and through the bank of the machine. I grasped the automated teller machine as a mixture of a counter and a strongroom that supplies and protects cash. The machine's display screens cash, it affords the withdrawal of funds from a client's account, and aligns the protection of money secured by the bank. I traced these couplings of clients, machines, and money in the making of cuts, or entanglements (Barad 2007), to the bank, tracking how people and cash are brought together apart at the cash point. I described the cutting effects of the automated teller machine with the figure of the pukara, as an arrangement that leaves the profits of banks out of sight. A topos of the Inka fortress, pukaras signalled how concealing banking activities, with the walls and the booths of ATMs, co-produces actions, apparatuses, and places (of resistance). I unpacked Luther Simjian's Bankograph from the history of the automated teller, to illustrate the way in which the ATM industry introduced this cash point machine, as an alternative to counters staffed with human

employees.

People and money entangled in the cash point are subject to movements that articulate banking services. In this sense I tracked how automated tellers screen the accounts of clients persuaded by banks to identify themselves, through their affective engagements with the machine's neoliberal optics (Hayward 2013). Examining the extension of this course of action, I attuned my fingeryeyes to the spacing of automated tellers – the making of the space in which they take a place in everyday life – and sketched with topological figures the enfolding of clients, machines, and money while moving sideways. With Garfinkel and Livingstone (2003), we read the ATM queue as an endogenously generated organization of an embodied spatial pattern. Recalling Cochoy's (2008) concept of actions traced in relation to adjacent bodies (or calqulation), queues demonstrate a trace-like pattern of filling up the queue by constantly making a line, cut by the gaps in between waiting bodies. With tori, I took note of queues as enfoldings of bodies cut together apart, in order to account for how non-queuing people go through the queue's gaps, which are constitutive of the enfolding. After queueing I reached into the fortification of automated tellers, the walls and booths that protect the cash point, including security props such as CCTV. These I noted by thinking with spheres how concealing automated tellers becomes a prosaic activity, that also articulates the trouble of passing by the cash point without being the client of a bank. Spheres helped me to stress how passages to access cash points cut gaps in the protection of automated tellers.

The *chiaroscuro* of the automated teller, the ways in which these machines are made visible that also obscure,lures people to identify themselves as bank clients. Automated tellers display accounts connected to databases of banks, and conceal what counts as fair banking – and for whom. In this sense I noted how Jess enfolded the space to withdraw cash, a space that sometimes people delimit by covering it with their own shoulders. Within this space another kind of cut took place: a

mutual exchange of cash for personal information. This exchange was partly hidden by the display of the automated teller – leaving out of sight how banks profit from people. I attended to this trade-off as an algorithmic dance of the client and the machine, performed by looping, twisting, and so withdrawing cash through a step-by-step procedure. This loop-and-twist-like pattern at the cash point may be compared to Klein bottles, which I used to grasp how the automated teller touches people daily. This moment of movement leaves no space to move sideways from the withdrawal. We are caught in between lines of force, in a web of relations of an apparatus threaded with a line in the centre, that links banks and automated tellers.

I considered how detaching people and cash from automated tellers doesn't necessarily entail tampering with or destroying the cash point. It means rather to relocate it in conversations about, and experiments in, making alternative currencies economic. In this sense I refigured Klein bottles as encounters of clients, machines, and money. I draw them in a projective plane or speculative horizon. Automated tellers for Bitcoin served as an example of this conjectural reconfiguration. What happens when what is concealed becomes visible, when trade is made accountable in Blockchains, displaying a full payment pattern between peers, while leaving people's identity hidden. I suggested that this opens circuits for cutting money differently; circuits that can be fostered by moving sideways with automated tellers in order to approach cash points as a place of resistance to the banking system.

The exit passage is the provisional end of this study of screens. Exit passages are the moments of movement that bring temporary closure to the relational webs of screens, disconnecting people and things from displays, moving them from one place to another. They are the spatio-temporal pathways through which people and things move away from screens. In this exit passage, I reviewed how reconfiguring practices, agencies, and affects with screens helps to resist the

extraction of values, the concentration of attention, and the exploitation of people and things touched by displays. By moving sideways I juggled with the moments of movement around, through, and away from the display of screens. This method is useful to study the embodiment of screens and the materiality of screenness: how screens display and conceal, making people and things present, manifestly absent, and Other. Moving sideways makes accounts of screens by following how people and things approach them, but without simply giving an overview of the action, or centring the attention on a single actor. Instead, moving sideways suggests that we study screens laterally. In this sense moving sideways implies engaging with the places of screens in everyday life, in order to cultivate a kind of Bergsonian intuition or sympathy for things, that also overlaps with the radical empiricism of William James (MacKenzie 2010:208). Inquiring into screens in this way fosters an open-ended, contingent, and situated method to study their empirical and material-semiotic relations. This engagement with screens can be taken further into encounters within various other sociotechnical alignments, that I might also approach by moving sideways. Bridges, tunnels, pipes, parks, stadiums, dams, highways, rails – what they align and how to learn to respond to what they dis/connect in specific locations – are all mundane matters that can be studied by moving laterally.

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