Learning in times of visual technologies: a relational approach to educational theory and practice that integrates external and internal images

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Abstract

We propose a new relational direction in educational theory and practice that acknowledges the significance of images both as external and internal representations integrated in thinking and therefore learning. We expand educational theory and practice that commonly rely on discrete conceptual developments that exclude the presence of images, both in mind and in external environments in practice. Our argument epistemologically relies on certain semiotic views that consider the role of iconic signs as significant in relation to thinking and knowing. We argue that the analogical and imaginative work required to discover similarity between external pictures and educational concept ideas is a form of iconic mind work that opens a space for transformational thinking and creative solutions. This outlook, we argue, takes images seriously, offering a grounding for a new orientation in philosophy, theory and practice of education. The novelty of our argument lies in the schematic philosophy of mind by C.S. Peirce, an explanation of how the mind interprets the world, and specifically his triadic sign diagramme. The diagramme is here applied with external images, exemplified via an "inquiry graphics" signs and method. Inquiry graphics are transformational image-concept signs and semiotic scaffolds that underpin relational thinking and education practice. They can support reflective, critical and engaging dialogic learning, addressing the visual proliferation and strongly visual character of contemporary media and technology.

KW: Semiotics, learning, icon, Peirce, inquiry graphics, Higher Education

Introduction

Recent seminal research in semiotics as a philosophical underpinning of education (McCarthy, 2005; Midtgarden, 2005; Semetsky 2010; Stables, 2005, 2006; Semetsky and Stables, 2014) opened new avenues for educational philosophy and theory, leading to a reconsideration of basic concepts therein. Such approaches, that have been at times labelled "edusemiotics" (Danesi, 2010, p. vii; Semetsky, 2016) or "semiotic philosophy of education" (Semetsky and Stables, 2014) are central to this article, particularly with regards to Peirce's semiotics. The growing literature along these lines (Pesce, 2011, 2013, 2014; Pikkarainen, 2011, 2018; Olteanu & Campbell 2018; Stables et al. 2018; Olteanu, 2015; Lackovic, 2018; 2020a; 2020b) constitutes a fertile framework for rethinking education and educational methods. It paves new philosophical pathways, detached from 20th-century analytic philosophy (e.g. Dearden, Hirst & Peters, 1972; Hirst, 1974; Hirst & Peters, 1970), which has been uncritically committed to logocentric (cf. Derrida, 1978, p. 246-248) and glottocentric (language-centered, see Cobley 2016) construals of knowledge, learning and teaching.

Our aim is to develop a relational educational theory and practice, arguing a relation between an educational concept and an external image in thinking and learning. This also means that relationality is inherent in iconicity, which relies on finding similarity between two diverse things, via an act of imaginative and creative mind work. Our arguments find inspiration in selected aspects of Charles Peirce's semiotics, such as his triadic sign model, and the work by semioticians that build on Peirce. We diverge from the view in educational theory and philosophy that considers the vehicle of knowledge to be the analytical *concept* understood *in opposition to image*, as expressed, for instance, by Richard Peters: "What is a concept? It obviously is not an image." (in Dearden, Hirst &

Peters, 1972, p. 3). This abstractist and conceptualist view strongly influenced (and still influences) the design of educational curricula and methods across educational levels internationally.

A timely criticism of the mentalistic approach to education and science is found in Dewey and Bentley (1960), who argued against educational reliance on "concepts" as some distinctive mental entities that exclude other modes. Instead, they proposed a processual, transactional view of science, production and development of knowledge. Thus, we adopt Dewey and Bentley's (1960, p. 192) concept/conception definition as "a current phrasing for subjectmatters designed to be held under steady inspection in inquiry". Dewey's view is both similar and distinct form Peirce's, yet relevant to our arguments. Concepts are always relational to socio-cultural histories (Blunden, 2012) and are not fixed mental representations located in the mind (ibid.). The perspectives that we develop integrate, in addition to Peirce, selected aspects of other semiotic theories (e.g. Barthes, Laclau) which, if taken in their entirety, would not be perfectly compatible with Peirce's semiotics. Our focus falls on the communicative and social role of images, in a broad sense.

In today's postdigital communication where images contribute to the blurring of online-offline as well as linguistic/nonlinguistic boundaries (Jandric et al., 2019; Lackovic 2020a), it is important to revisit what a concept is across disciplines. We do so by adopting selected semiotic lenses of Charles Peirce's semiotics. This thinking is also a reaction to the iconic turn: we acknowledge that the iconic turn can mean the renewed interest in images as part of contemporary visual technologies, a new interest in the images of the mind (mental images), and in external images in relation to education and society. Our ideas relate to all these three aspects and we focus here on the last two notions of the iconic turn, exploring it by and large from a Peircean semiotic vantage point.

Semiotics, sign and thinking in education: more than words

Semiotics is the science and philosophy of signs. According to Peirce (CP 1.346, 2.228), a sign is briefly defined as something (representamen or sign) that stands for something else (its object) in some capacity (interpretant as sign meaning and effect). For example, a picture of a dog (representamen) represents a dog (object) as the mind creates an idea of a dog, which links to emotion and action that this idea leads to in the given dog and picture context. Mind and consequent behaviours are accounted for in Peirce's triadic diagram of the sign, by which Peirce offered an account of thinking as engagement with representations. Although philosophers have grappled with the question of representation since classical antiquity (Manneti, 1993), we focus on Peirce's view here and present a novel way of applying his triadic sign in relation to images and educational practice.

Thinking is more general than what can be expressed through language alone and language is, however important, one incarnation of thinking among others. Meaning making in the human world involves both language and nonlinguistic elements, such as images: "(a) meaning is the associations of a word with images, its dream exciting power." (CP 4.56) Meaning is the only currency of the mind, intrinsically linked to emotion and action. As Short (2007: 4) explains, Peirce's notion of mind as semiotic and, in contemporary terminology, multimodal, avoids language-centrism without missing the important and formative role that language plays in the human, subjective world:

> "Peirce did not limit thinking to the verbal – it can be diagrammatic and otherwise in images – but we think mostly in words, and thus our capacity to think is dependent on our having learned a language."

This is one of the main reasons for which Peirce has been recently adopted in educational philosophy (see Olteanu 2015) and his pragmatism came to the fore of contemporary semiotic inquiries. It

accommodates the contemporary understanding in philosophy and linguistics that metaphors, together with the images and diagrams on which metaphors depend, are unavoidable structures in our conceptionalization of the world (Lakoff and Johnson 1980a, b).

From this perspective, the outer world is pregnant with meaning (Sebeok 2001: 3) and when meanings emerge, they cause action, reaction and a mental charge, that can have intellectual, emotional and/or physical form. Signs are always signs in action and signs for action (Strand, 2014; CP 5.569). In this regard, the actuality of Peirce's semiotics for learning and educational theory is apparent. Particularly in a world of accelerating complexity of communication, it is insightful to acknowledge that "[i]f all living is semiotic engagement, then learning is semiotic engagement" (Stables, 2006, p. 375). That living is semiotic engagement means that humans and living organisms interpret and act their life in relation to the signs by which they organize their surroundings and environmental forces (Lackovic, 2019, 2020b; Olteanu, 2019). This hypothesis has constituted the main reference in semiotic approaches to education, implying a strong connection to ecosemiotics and biosemiotics, the non-anthropocentric semiotic theory of biological modelling, which starts from the premise that life and meaning are coextensive (Sebeok 2001, see also Olteanu & Stables, 2018) and that to be alive is to be in semiotic (interpretative, embodied, material and relational) engagement with the environment (Kull, 2009). Therefore, the role of education is to empower students to discover and reuse semiotic resources according to ever shifting conditions characteristic of pressing world challenges (Gough, Stables 2012). These challenges are currently visible in the ways in which we understand (interpret) the environment and act in it. Examples vary from how we understand food and act upon it (an obvious reference is intensive farming), to how we understand and act in regard to natural resources, climate, justice, or the communities close and far.

From a relational semiotic perspective, education should not aim to facilitate only fitting into one society or caring for immediate surroundings, but enhancing adaptive capabilities both locally and globally, in ways that often challenge the *status quo* (Olteanu, 2019). This is to say, aligned with Gough and Stables (2012), that education should aim to cultivate individuals' capacity to interpret, as the most effective adaptation strategy, as interpretation leads to action and adaption. The role of education is then not that of delivering only the sociocultural conventions of any given human societies, but to consider humanity and the biosphere at large, comprising the non-human world. In this regard, we notice the instrumentality for education of external images, which invite critical reflection upon the world's materiality and environmental factors. Logocentric, excessively symbolic systems, such as dominant in the modern world initiated through the print medium, inculcate an illusion of both the distinctiveness of human cultures (Gal and Irvine 1995, Olteanu 2020) and humanity's distinctiveness from the rest of nature that lies at the epicenter of the environmental crisis.

Supporting reflection and learning with images results in the competence of *iconic intelligence*, which liberates "from the demands of language, from canonical texts, or from other mimetic instances" (Boehm and Mitchell 2009, p. 106). In the case of blind and visually impaired learners, iconic intelligence does not necessitate sight but a mental-iconic manipulation, as explained later via diagrammatic reasoning and creativity. Actually, Peirce (CP 1.312) exemplified the type of creativity that modern education misses (or even obstructs) through an anecdotal example of how a blind person might have a representation of something visual through a cross-modal iconic inference: observing a quality in the blare of a trumpet that is also present in (descriptions of) the colour scarlet. While our focus falls on the role of external images in thinking, the external scaffolds can be of different sensory character. The much-lauded concepts of imagination and creativity, from this point of view are equally scientific and artistic, foregrounding the capacity to discover new, not yet inferred relations of similarity (see also Tan, 2001) via available and imagined scaffolds. It is creativity, thinking and acting in this sense that semiotics points education towards. As Gough and Stables (2012) explain, semiotics frames interpretation as a form of adaptation (to the world that evolves), particularly useful in times of crises and epistemological uncertainty.

Semiotic iconicity and its relevance to education: learning as iconic sense making

It can be said that the aim of education is to introduce new signs and sign systems to the mind and environment of learners in ways that facilitate the development of more complex systems. By their constitution, the primary goal of signs is evolution. Signs change and evolve over time. Regarding the relation between the sign's object and its representamen semiotics recognizes *icon, index* and *symbol* as basic sign types (CP 2.247-249). Symbols refer to their object by (socio-culturally) agreed convention, such as a linguistic system, or an image that symbolizes an idea to most members of a culture/society by convention (a road work sign means that there is ongoing road work ahead). An index has a diagnostic quality, as it signals something else that its form does not overtly show (a smoke is an index for fire, a sneeze for particular processes of the human body). In actual experience, signs often act as compounds at the intersection of icon-index-symbol, as an inquiry graphics process, presented below, accounts.

We are primarily interested in iconicity, the phenomenon of signification due to similarity (Stjernfelt, 2007: 49), which serves as ground for more complex indexical and symbolic meaning when an external image and an educational concept are brought together. An iconic sign, following Peirce (CP 2.247, 2.276), is meaningful on account of the similarity between representing form and represented object. Such are the cases of a photograph signifying a person because of the visual similarity between the imprinted qualities and the actual person or an onomatopoeic vocalization signifying another sound/action/entity because of the perceived auditory similarity.

The hypothesis that *iconicity* is seminal for meaning-making (cf. Elleström, 2014; Stjernfelt, 2007) and scientific reasoning (Pietarinen and Belluci, 2016) implies that *any apprehension requires observing similarities via corporeality*. Observing similarity involves operations of cross-modal translation by analogy: these are associations that require establishing common denominators between two "things". When one of them feels new to the learner, they need to draw on what they have experienced or learnt before to draw analogy. The link between phenomenological corporeality and iconicity is foundational for the iconic turn in terms of how we experience the world and think about it (Boehm and Mitchell 2009, p. 110-111, Stjernfelt 2007, p. 53). By seeing shapes, one can anticipate or know how an object could be grasped and handled. By seeing and analyzing an image and its various details and elements, one can anticipate and speculate new connections between that image and any topic being learnt.

Making sense of one's environment, thus, implies the discovery of useful similarities, many of which are not obvious or immediately known by observation across entities, meanings and actions (how these connect). This discovery of similarity happens by practical or mental (simulation) experimentation, also called *diagrammatic reasoning* (Stjernfelt, 2007, Pietarinen and Belluci, 2016). Links between external and internal images (ideas) are established through diagramming reasoning. Given the plurality of sense perception channels of human corporeality, such experimentations consist in mental manipulation that involves cross-modal iconicity (see Stjernfelt, 2007, p. 91-92). Such inferences are critical for imagining, all the way from mundane matters, such as how to cross a street, to scientific investigation. Peirce used the term diagram to refer to the particular type of icon that signifies due to inner part-whole similarities, that is, through its schematic structure. To explain thinking as implied by this notion and in regard to external objects that can include external images, we refer to one of Peirce's diagram definitions, provided also by Pietarinen and Belluci (2016, p. 474), that means

> "a concrete but possibly changing mental image of such a thing as it represents. A drawing or model may be employed to aid the imagination; but the essential thing to be performed is the act of imagining" (MS 616, 1906, our emphasis).

The supposition of the iconic turn, following Boehm and Mitchell (2009 110) and Stjernfelt (2007) is that a knowing subject can learn something (develop schemata) only if a sufficient level of similarity between what one knows at that given moment and what is to be learned can be sensed (e.g. observable, but not necessarily). Such similarity (between the known and the yet unknown) is a prerequisite for knowledge development, understood as meaning-experience expansion. For educational purposes, examples from real life and concrete instances are useful insofar they create a situation of comparison, even if this raises a question of "accuracy" (e.g. when learner-observed similarities are seen as scientific or disciplinary misconceptions, see also Olteanu et al. 2015). That is precisely the reason why an understanding of iconic evolutionary learning is currently opportune in education: it justifies the free sharing of beliefs and conceptions by learners, including supposed misconceptions, in a community where no one's knowledge or knowledge *per se* is presumed as given and absolute, without implying fact-denialism and falling into "everything goes" relativism. Recalling Dewey and Bentley (1960), any concept is only the current state of knowledge (as accepted by some knowledge authorities), and has to be subject to inquiry (Lackovic, 2010).

For education, the iconic turn means that understanding things is a type of semiotic modelling of both verbal and nonverbal signs. Concepts are not monomodal mental entities, expressed only analytically, but they always rely on embodied and sensed schemata, using the celebrated terminology of cognitive semantics (Lakoff and Johnson, 1980a, b). The iconic turn in semiotics is connected to the recent (re)discovery of Peirce's schematic and diagrammatic semiotics (Ransdell 1979, Pietarinen, 2006; Stjernfelt, 2007; Pietarinen and Belluci 2016), kick-started by Eco's (1997) reconsideration of Peircean iconicity and resulting debates on perception and conception. These extensive debates amount to the idea that meaning does not stem from conventional codes only (languages). Rather, human conventions are founded upon meanings that humans discover in their environments, throughout life, and which facilitate the further development of more complex meaning (a process of *scaffolding*). Conventional meaning, such as symbolic, is useful only if grounded in iconicity: while a variable used to draw the behaviour of a mathematical function is revealing, an abstract, context-less variable is useless, argues Stjernfelt (2007: 91). To be operational, the variable and the function must have a link point that brings them together, to convey meaning to a mind.

Photographs as icon-index-symbol signs through Peirce's sign triad

Following Peirce, "meaning" is *semiosis*, a triadic process of interpretation (CP 5.484). If we consider a photographic picture, the Peircean triadic model (CP 1.541) of meaning-making reveals the iconic sign therein as consisting in (Lackovic, 2020): (1) Embodied/pictorial representamen (a part of Peirce's representamen for pictorial signs), which here means the pixels of digital image that to human eyes look like concrete shapes and "things" that can be seen and named, (2) Object that the image stands for by similarity, and (3) Interpretant, the meaning which an interpreter concludes from the observation including the feelings and acts that this triggers (Figure 1). The triadic model differs from the spread notion of meaning as double articulation (de Saussure, 1959; Martinet, 1962) of (linguistic) form (signifier) and meaning (signified) (Kress & van Leeuwen, 2001, p. 4).

Interpretant (Photographic meaning)

P = icon-index(-symbol)
PHOTOGRAPH

Representamen
(Photo existence; photo form)
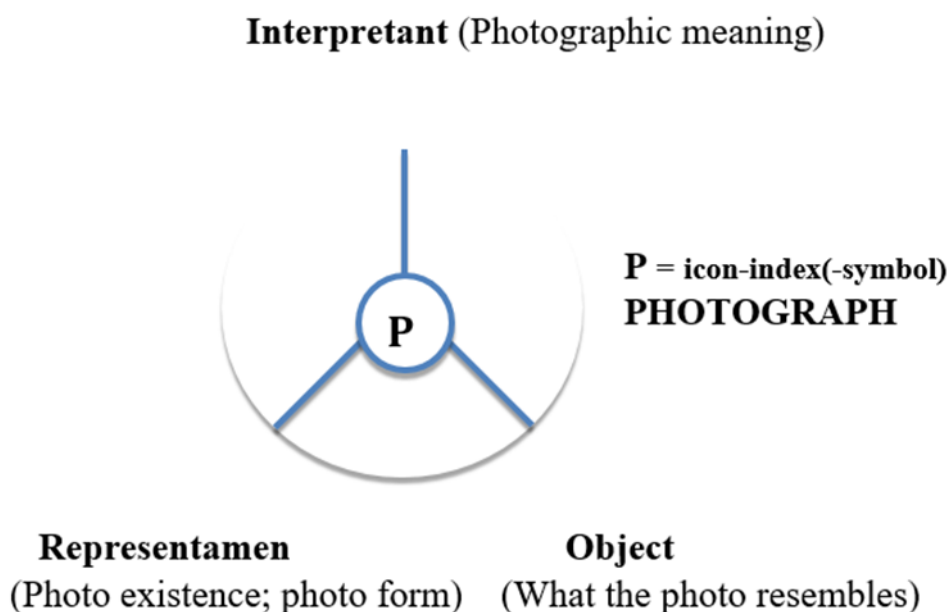
Object
(What the photo resembles)

Figure 1. A triadic sign interpretation schema of an iconic external image, here a (digital) photograph (building on Merrell, 2005).

Peirce's vast and varied work offers a theory of mind that we cannot fully account for here, but we can explore it via a distinct focus on the triadic sign, which is a sign in action, not a passive entity that serves just to decode some pre-fixed meaning. Therefore, meaning in Peirce's terms involves feelings and social action, reaction and impact. In our concern, education incorporates ideologies and has a political load carried through signs, especially those that are hybrid and combine icons, indices and symbols. For a critical reflection on the ideological charge of education, the icons on which ideological symbols rest must be differentiated. However, this does not mean the deconstruction of a fixed, rigidly codified sign. A sign can be analyzed but sign meaning is not just a one-off instance of interpretation, but an evolving phenomenon, as negotiated collectively and historically.

Such consideration leads us to invoke a critical or political stance of the sign, rarely considered as linked to Peirce's semiotic triad model, other than the exception of Petrilli (2014), who sets a fertile ground for the notion of critical semiotics as semioethics, arguing the interconnectedness in otherness. In simple terms, being different asserts a unique character that implies also a similarity and, therefore, a link, an iconic relation. Hence, our view is also a work of "educational activism": the adoption of the iconic turn in education is radically different to any approaches centered on *difference* rather than *similarity* as criterion for learning. Difference supposes similarity and similarity embraces difference, as an iconic link among diverse things. In that way, we propose an iconic, relational education that celebrates diversity.

Iconicity is proposed as the primary and integral character of interdisciplinary education that promotes relationality among all worldly things and concepts. As the key lies in an effort of imagination, we point to the means of cultivating imagination through thinking with images. This is not to propose seeking obvious, redundant or visual similarity but similarity in apparently different, even divergent phenomena, to connect different things, such as an image and a seemingly unrelated educational concept. This facilitates the mediation of a new, previously unforeseen interpretant. The sedimentation over time, through habituation, of a once improbable interpretant can render an understanding of the image-concept sign in a joint conceptual and physical sense. The image can offer an opportunity to seek similarity that is beyond the image, in metaphorical expression, to seek connections that are not pre-mediated, by (institutionalized, established) image makers or immediately

observed. We exemplify this in the following section below, in a concrete illustration of how an image connects to an educational concept.

By engaging in "relationality" through thinking with images, students are invited to contemplate, to search for similarities and relations, which includes distinctions, across various domains and modes of life at micro visual and macro conceptual scale. They are not meant to discover (only) what teachers already know but, following Pesce's (2020) argument, what only they can uniquely discover. In this way, they become better situated for developing creativity, adaptability and in-depth understanding of interdependency of all things in the world, which challenges any divisive educational, media or academic rhetoric that foregrounds toxic *difference*. Olteanu (2019, ix) challenges the promotion of identity and culture prevailingly built on preferred difference, which is not relational and truly multicultural, highlighting populist abuses of identity "for the purpose of generating conflict and separatism" where "[t]o have an identity means to be different from others. To have a cultural identity means to be the same as some, by opposition to others." We do not challenge difference. Our proposal does not imply a conglomerate global identity, but we argue that by recognizing difference, one has to recognize the underlining similarity as a pre-requisite for difference.

In an edusemiotic orientation of action towards becoming (Stables 2012), emphasis is placed on learning as creatively seeking possible solutions from an educational stance to address issues pertaining to sustainability, such as the environmental crisis, poverty, displacement and stark socio-economic inequalities, struggle over natural resources and geopolitical (dis-)advantage. In political discourse, these concerns are usually framed within a separatist (rather than relational) discourse and are not an overt part in most educational curricula despite their paramount importance for our wellbeing and even survival. This situation is effectively a denial and perversion of the relational character of all things, and more precisely the connection between humans and our close or distant environments. Imagining solutions is not expected to come out of nowhere but based on existing semiotic resources such as images and other artefacts, which, by an effort of imagining similarities anew, become scaffoldings (Cobley and Stjernfelt 2015) for future development. In an educational system that to a good extent teaches definitions, rules, and laws as fixed and authoritative human knowledge, demanding "certainty" (White, 2014), the instability, precariousness, fragility and complexity of the contemporary human world is not well accounted for.

Inquiry graphics practice in higher education

We proceed to illustrate our points and arguments through an example of an inquiry graphics (IG) signs and method (developed by Lackovic, 2016; 2018; 2019; 2020; 2020b), followed by further grounding in Peircean semiotics. IG are compound semiotic signs, the signs in and for educational reflection and action that integrate external iconic images in inquiry processes and internal images of the mind to support learning. Such practice (as signs are actions) overtly stimulates and simulates diagrammatic reasoning and the manipulation of (what Peirce termed) existential graphs (EGs, more in the section below). More specifically, an IG learning method suggests analytical steps, following the earlier introduced Peircean triadic sign model of interpreting the photograph, in an analytical format (Embodied Representamen-Interpretant-Object) to scaffold the inquiry.

An IG pedagogy means developing learning designs that embed external iconic signs into inquiry thinking. This includes reflective and critical tutor-learner or peer-to-peer dialogue and narratives developed around these graphics (for an example of a pedagogical design see Lackovic, 2010b). It commonly involves a student-selected or created image or artefact (e.g. a photograph taken by the student or found on the internet, but can be a video or a drawing, either found or created), to represent an idea, theme or concept. The systematic method requires students to observe and list all details (called Embodied Representamen's Elements) in the form of grammatical nouns, or logical

*rheme*s (predicates) in semiotic terminology. Peirce considered rhemes unsaturated signs, because they leave a "blank" to be filled, which only have a potential to convey information. Filling that blank results in conveying information (CP 2.272, Stjernfelt 2007: 31, 2014: 57, 2015: 1025-1026).

Simply put, nouns (rhemes) such as child, dolphin or flowers are blanks that are not information as they only state existence or presence, and a possibility for action and information. This naming of pictorial elements is useful as it reveals what someone notices or does not notice, how someone defines the element observed, and importantly it opens up a space for iconic mind work so that the socio-historical meanings and "lives" of these elements are linked to the meanings of an educational concept or a learning goal that they would not be obviously connected to otherwise. For example, if we consider Figure 2, there is no obvious link between "goggles" as an element in the picture and the concept "constructivism" but establishing a relation between these two can lead to a revelatory insights on the concept (what is the role of googles (worn by two children) in a constructivist experimentation by young learners?). Alongside Elements, students would identify two layers of meanings (sign Interpretant): denotative (descriptive meanings (e.g. with the phrase "looks like"), subject-predicate-adjective/adverb descriptions of what the named Elements are like to students) and connotative (what the denotation can mean, reliant on both representational cues, socio-cultural considerations and interpreter's context) (adapted from Barthes (1967,1977).

The denotation-connotation distinction within the Interpretant draws attention to how qualitative characteristics of animate and inanimate Elements depicted in an external image (=denotation) can constitute "social life" and become socio-culturally and symbolically constructed and contextualised (=connotation). The distinction is not to claim that denotation or for that matter Representamen is not social, cultural or interpretative; indeed, as far as human experience goes, it is. The distinction between the two is not settled. As learners choose an image to represent a concept, either start with an idea or with an image, the Conceptual or Assigned Object in IG (also called Research Object in research, see Lackovic, 2018) is assigned to the Peircean Icon Object (what the image elements represent) for inquiry purposes and acts as an added symbol to the IG thinking sign. It further adds a layer of meaning to that of the iconic and symbolic connotation of the image itself in an IG process. This functioning of an IG can be related to Pietarinen and Bellucci's (2016, p. 472) reflection:

> *Peirce's claim that in a diagram "the signification of the symbol becomes the object of the icon" is really revealing. A symbol is a sign that carries information. Any proposition does so; any term or predicate does so, at least virtually; any argument does, and in a peculiar way (carries information that in its turn will become a source of further information). An icon, on the contrary, is a sign "from which information can be derived" (MS 478, 51–57, 1903). An icon represents the information contained in the symbol in such a way as to render further information derivable from it. In traditional terms, the Icon denotes what the Symbol connotes.*

For example, a statement "two children shown with particularly shaped dishes and liquids in an environment" (see Figure 2 below) is a possible example of a *denotation description.* The connotation of this image could mean that some pupils are participating in an act of experimentation in a lab environment where they engage with specialized chemical equipment to understand a concept (e.g. a chemical reaction). This denotative-connotative description distinctiveness emphasises how the depicted composition, (its *ingredient*s) and its assigned socio-cultural meaning are intrinsically entwined, but they are not the same. Meanings are assigned to what we see all the time. The Iconic Object refers to the children who were photographed and their described action. The assigned Conceptual Object-Interpretant, that is "*constructivism",* acts to stimulate thinking and contemplate meanings of the pictured in relation to the assigned concept (Figure 2).
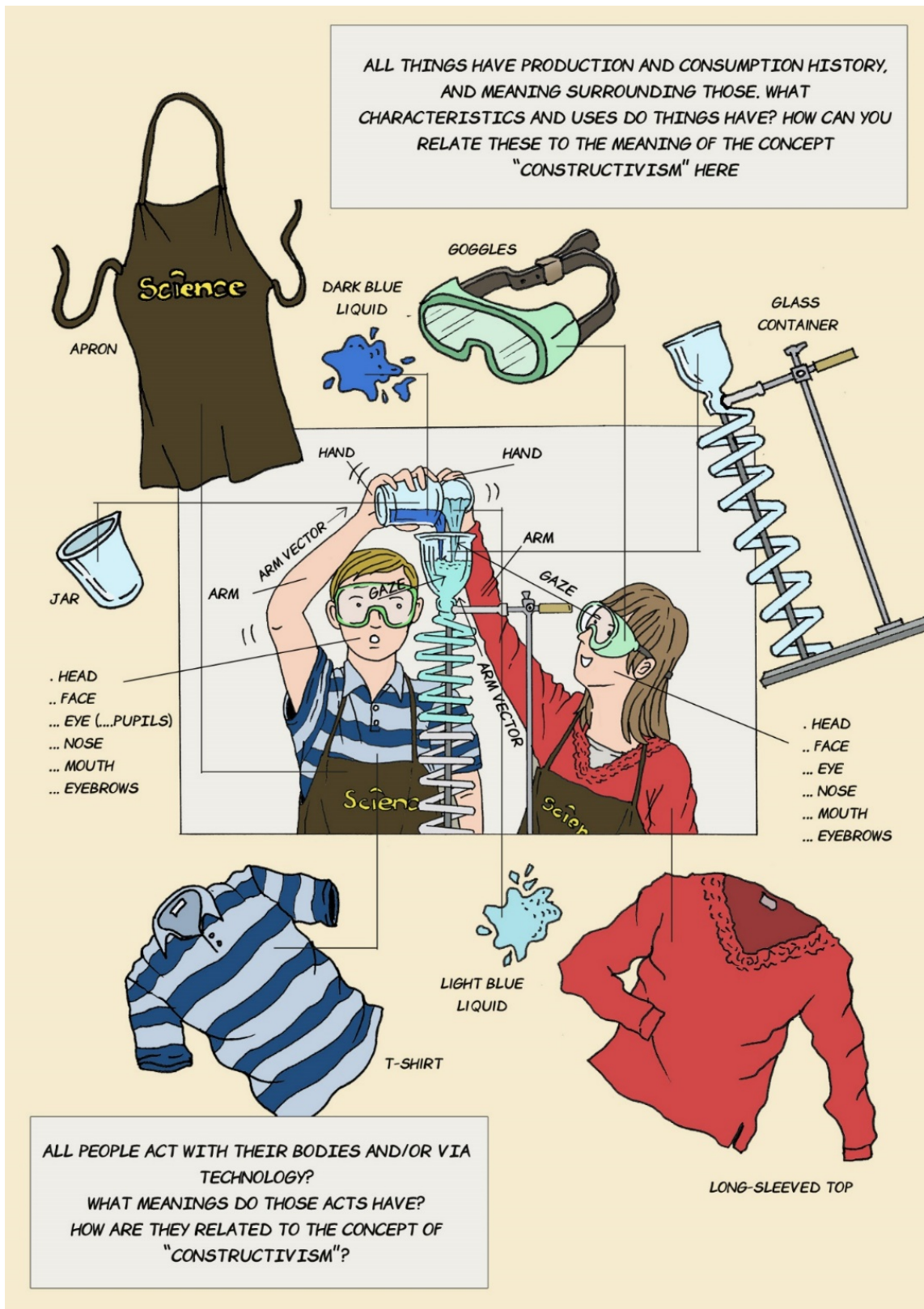
Figure 2. A drawing of the photograph chosen by a student and shown in the centre, developed by Lackovic (2020b) to reflect on the concept "constructivism". It shows individual Elements extracted to float around to emphasise that they can on their own (their varied possible or expereined meanings/uses/effects) be subject to new ideas and inquiry in relation to the concept. Image author: © Andi Setaiwan 2019

In an inquiry graphics empirical study with MA students of educational psychology where images are used for reflective practice and concept development, in most cases, interpreters/learners jump to the image's holistic connotative meaning, without paying closer attention to image details and how these can inspire conceptual reflection (Lackovic, 2020b). It is not to say that any such connotative reflections are good or bad, but to emphasise that, if images themselves are treated as analytical sources rich in detail and meaning potential for reflective thinking, and not only as illustrations or mere triggers for reflective narratives, then they become more integrated into thinking and learning processes. This is especially relevant to the stimulation of imaginative and creative thinking. IG signs open further possibilities for creative insights, contemplating a link between abstract academic conceptualisation and the material world. Otherwise, they might not go beyond the decorative or referential role in learning (Hallewell and Lackovic, 2017). The key reason for using IG in education is to support concept-image analogical thinking (*iconic intelligence*), by seeking concepts and ideas in an external image representation by systematically unpacking its meanings, which are often contested, and reveal deeply held believes. This corresponds to Pesce's (2020) and Kahneman's (2011) reflexive thinking. Images that show things, action, world's materiality (Figure 2) are imbued with histories, uses and meanings that can inform an in-depth learning inquiry.

To explain further, Figure 2 shows some pictorial content. The content does not show (the concept of) constructivism at the level of pictorial elements and their relationships. However, by diagrammatic reasoning, this image can be related to the concept through our experience of the world, exploring how and with what known and possible socio-cultural or ideological underpinnings the concept manifests itself in the material world that the picture represents. The student who chose the image, started the inquiry with a concept, not with the image, thinking about the concept an hen trying to select an image that according to the student shows an aspect of the concept martialized in some sense. This exemplifies thinking as "world-making" (Bruner, 2009), that bridges logically known worlds with intuitively possible worlds (see Pietarinen and Belluci, 2016). It is the type of creative thinking that avoids conceptual dead-end alley views (seeing just one solution or option) but seeks links across abstract concepts/ideas and visually represented materiality. The implied plurality of meanings (Laclau, 2005) stemming from one image or one concept, challenges educational practice of promoting fixed meanings and definitions (White, 2014). Although defining concepts is useful and if we may say necessary to establish one's position (epistemology/ontology), concepts are interpreted and used in various ways to mean various things and this has to be acknowledged.

Semiotic scaffolding and existential graphs with concept-image signs

The exemplified IG sign and an IG analytical approach of iconic diagrammatic reasoning for teaching-learning is here further grounded philosophically and theoretically in relation to the notion of scaffolding. It links to Bruner's (1957, 1960, 1966) scaffolding processes, usually with external "aids", termed scaffolds or scaffolding, which facilitate students' exploration. In semiotics, Hoffmeyer expanded the notion of scaffolding (Hoffmeyer, 2006, 2014, 2015a, 2015b, 2015c) to comprise not only structures provided by a teacher, but meanings that learners use in designing their own models of the world. In that way, something which is an aid becomes more than an aid, it becomes an integral part of meaning making processes, supportive in initiating new insights.. The material-conceptual context at the moment of thinking, as well as the meanings shared by peers, contribute to the process of scaffolding. From this perspective, knowledge is relational and in flux: everything a person learns must be supported, in some ways, by what she already knows. As such, signs are considered as open-ended entities, always in the process of evolving, with possibilities for alternate meanings.

This finds connection in a range of theories of meaning, from Bakhtinian dialogism and Carroll's anarchonovelisation (White, 2014) to Deleuzian "assemblag(ing)" as "a becoming that brings elements together" (Wise, 2013, p.91). Semiotic scaffolding is here understood as a basic process by which any organism learns and adapts (Olteanu, Stables 2018), namely "what makes history matter to an organism (or a cultural system)" (Hoffmeyer, 2015a, p. 154). According to Gough and Stables (2012), the semiotic view of nature and culture diverges from Enlightenment anthropocentrism, the dominant approach to contemporary education. Learning as semiotic scaffolding is "the piecing together of the semi-autonomous parts of a scaffolding," via a process of diagrammatic reasoning (Cobley & Stjernfelt 2015, p. 292), exemplified above via IG.

While the iconic turn (Stjernfelt, 2007; 2014, Pietarinen, 2006; Moxey, 2008) underlining the discussion in this article has been particularly prominent in semiotics, educational research and theory have not followed up on this line of inquiry to address what this means for education and consider how Peirce's semiotics fit in. Educational practices in many disciplines remain entrenched in logocentric and glottocentric practices. Despite underpinning the iconic turn, Peircean semiotics has been empirically and practically applied only scarcely in this direction, especially in higher education research (e.g. see Hallewell & Lackovic, 2017; Lackovic, 2010a, 2018). As of recent, a tendency towards this approach is observed in theoretical semiotics (Campbell 2018; Chiasson, 2005; McCarthy, 2005; Nöth 2014; Olteanu 2015; Pelkey 2018; Pesce, 2014; Stables et al. 2018, Strand, 2013a, 2013b; Wells, 2009). Given the fast pace of publication, assessment and professional training challenges, as well as fixed focus on learning goals, contemporary academia, in general, allows little time for in-depth analysis or transformation of methods. Our proposal represents one way for educators to counteract this struggle, by engaging learners in a semiotic dialogues around relationalities between (1) visual-sensed-material and (2) conceptual-ideological world, seeking and leading to ways of acting.

Going back to Peirce, Peirce's system of EGs (Existential Graphs) can be a useful way to explain thinking and account for cross-iconic meaning-making and subsequent acting. The system consists in "a certain class of diagrams upon which it is permitted to operate certain transformations." (CP 4.414). According to Peirce, the "purpose of the System of Existential Graphs, […] [is] to afford a method (1) as simple as possible […], for representing propositions (2) as iconically, or diagrammatically and (3) as analytically as possible." (CP 4.561), akin to the IG analysis. This graphic system of logic representations encompasses what Pietarinen and Belluci (2016) call "diagrammatic imagination". Diagrams are icons that "represent the relations […] of the part of one thing by analogous relations in their own parts" (CP 2.277, see also Stjernfelt 2007: xvi, 89). Diagrams afford transformations, that is, mental experimentation. They explicate how semiotic scaffolding unfolds. The discovery of similarity that affords a new coupling of scaffoldings is an *analogy*. Mental experimentation can be scaffolded as exemplified via IG. Thinking is, in this view, a diagrammatic and embodied experience that can be pragmatically illustrated by a concept of Peirce's EGs. Learning is possible because the learner can imagine the studied object in some way, new and however inexact and vague, and can manipulate certain complex diagrams of it, that although mental do not reside in the head, but extend into the environment with semiotic (thinking) scaffolds.

The threefold rationale of EGs implies that cross-modal transformation is intrinsic to learning, as it always includes some spatial and/or iconic sense together with language (cf. Boehm and Mitchell, 2009, p. 119). The first criterion of EGs is to represent propositions showing that the first structures (levels) of meaning humans encounter in their waking experience are corporeal sensed judgments (CP 5.53), in the form of propositions (Stjernfelt, 2014). Propositions, or dicisigns, as Peirce named them (CP 2.251), are signs with a Subject (a noun, rheme)-Predicate (verb + adjective/noun/adverb) structure. When describing a picture and what the relations in the picture are like more literary (than symbolically), this is IG denotation (Barthes, 1967, 1977), albeit the line between denotation and connotation is never exact and clear (we cannot exactly pin down where the qualitative description

ends and the socio-culturally assigned meaning starts, but there still exist nuances in meanings (as we will interpret situations based on the cues we get form all the details we are engaging with, hence every detail matters). Without context, icons signify nothing more than a possibility. EGs exemplify a schematic way of thinking that works via a creation of iconic links among assertions by applying analogy and associative reasoning.

Our argument does not deny the need of conceptual definitions but perceives concepts as multimodal, open-ended and not as iconless symbols. Unlike the notion of concept in analytic educational philosophy or educational research and theory that overlooks the role of (external and internal) images in thinking, an inquiry graphics (IG) embodies a new way to understand concepts in education. Via an IG sign, the concept is not abstract but grounded in external materiality that can be shown via an external icon, thus forming an abstract-concrete, concept-image sign – a new relational concept. To explain further, if we talk about constructivism, this concept would be manifested in the world in some form. If we talk about any abstract concept (social justice, metacognition, power, democracy), it must mean that the concept has some material or spatial grounding and manifestation, even if only imaginary. An external image (icon) acts as a reminder of worldly materiality, spatiality and granularity (unlike linearity). When learners are not prepared to understand, consider and explore the pluralism, contextuality and instability of meanings (Laclau, 2005), concepts and matter, awareness of human vulnerability to fixed meanings and manipulation mediated by signs is undermined. Interpretative rigidity undermines the role of education as a conduit for civil society: dogmatically following fixed rules is autocratic, while dismissing hard, empirical facts is dangerous. The exemplified IG method practices critical engagement via reflective and dialogic engagement with images and artefacts integrated into it, which challenges image-concept dichotomy and conceptual rigidity.

Conclusion

The article introduced and exemplified a relational approach to educational theory and method, as iconic and diagrammatic thinking that include both internal and external images, via the notion of iconicity and inquiry graphic signs. This is especially important in the current world of visual technologies, and the commonplace undertheorizing of technological visuality, visual media and design in educational and "technology enhanced learning" research from a semiotic perspective. We build on selected and focused aspects of Peirce's semiotic theory of mind and triadic sign model and exemplify relational and iconic thinking in practice with images, via an inquiry graphics (IG) method. The key novelty is in our interpretation of Peirce's semiotics (building on Lackovic, 2020) and its role in educational theory and practice. Our practical example shows how an aspect of educational psychology "constructivism" is manifested in an image. That image was not originally meant to show the concept "constructivism", but it can do so via creative and imaginative mind work, as diagrammatic iconic thinking. It is this intersection of an (external and internal) image and a concept, abstract and concrete, that forms an inquiry graphic sign.

We discuss how such relational thinking and learning involve iconic operations, the creation of relations based on new similarity, underpinned by recent trends in semiotics, particularly Peirce's logic and philosophy of mind. The practice of inquiry graphics, informed by the presented semiotic notion of iconicity, can be implemented as a relational educational method to support creative, reflective, relational and pluralist thinking with images. As a future direction for IG use, we argue that such a relational approach in educational theory and method is useful and needed in a climate of populist and separatist discourses and actions. Iconicity and IG signs promote the notion of difference as needed diversity, and the notion of similarity is what connects us in difference, across global education spaces.

Considering these views, we bring to the fore the role of iconicity in learning. Bruner considered the activity of "imaginary world making" as underlining everything: science, literature, philosophy, everyday thinking, and a sense of self. We argue that imagination and creativity in the sense of iconic relational thinking and inquiry graphics signs is needed as a new approach to learning theory and practice, to achieve a more insightful understanding of social complexity.

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