

*Psychology, evolution and the traumatised child: exploring the neurophysiology of early sexual development*

Epidemiological research indicates that adopted children are at increased risk of early sexual development. Evolutionary psychology tries to explain this connection in two ways: arguing that early stress hastens sexual maturity through a kind of embodied fear of death; or by suggesting that early development is an adaptive response to improved life situations. Both explanations are problematic. In contrast, research by Stephen Porges on the evolutionary neurophysiology of early childhood trauma provides important insights into the persistence of behavioural and physiological patterns in neglected and abused children and may go towards explaining early development. More broadly, this work also highlights new avenues for theorising the entanglements of body, brain and behaviour that are central to contemporary feminist thought.

Key words: Polyvagal theory, sexual development, puberty, adoption, childhood trauma, evolutionary psychology

My recent book *Puberty in Crisis* explores policy, news-media, scientific and biomedical debates around contemporary changes to pubertal timing indicating that more and more children (particularly girls) are experiencing early onset or precocious puberty, with over 40% of girls in some populations starting puberty before the age of 8 (Roberts 2015). Explanations of these changes variously pay attention to genes, obesity, environmental toxins, childhood stress and 'sexualising' elements of culture such as pop music videos. In the book, engaging with this diverse range of explanations allows me to explore the role of biological actors such as genes and hormones in the making of sexed bodies. How do hormones contribute to the making of sex that develops from puberty? How can we come to know and engage with hormonal actions without aligning ourselves with troubling biological essentialisms? How might it be possible to think about biological processes, flows and encounters as part of sex and sexuality whilst remaining committed to feminist projects of recognising inequalities, resisting oppressive normativities and fostering and celebrating differences?

In this paper I develop one strand of this line of questioning further, asking whether evolutionary accounts of brains and behaviour might help us to understand pubertal timing, particularly the increased chance that children with early life trauma (that is, those experiencing neglect, abuse and/or highly disrupted care) will experience early sexual development. Engaging with two rather different kinds of accounts of this connection, I explore the possibility that alongside the rich and important tradition of feminist critique of evolutionary psychology, we might develop a different relationship to some scientific accounts of the evolutionary neurophysiology of human emotions, a relationship that allows us to develop new lines of thought around bodies and their individual, relational and collective histories.

### **Early trauma, early puberty?**

Early onset puberty is now so wide-spread it is referred to as a ‘secular trend,’ meaning that it reflects significant changes to population norms that are not the outcome of any particular pathology or disease. The epidemiological literatures on pubertal timing describe several groups as being more likely to develop early, including African-American girls, over-weight girls and internationally adopted boys and girls. Studies of pubertal timing are varied but as a ‘gold standard’ involve breast palpation (to distinguish fat from breast tissue) and observation of pubic and underarm hair growth. Some studies focus on clinical populations (children whose parents are concerned enough to seek medical attention), whilst others study samples of the general population.

Over the past 10 years many parents of children adopted from developing countries, including India, South Korea and China, have reported that their children go through puberty earlier than peers in their adopted countries (often in Europe or North America) (Virdis et al. 1998; Mul, Oostdijk, and Drop 2002; A.-S. Parent 2003; Teilmann et al. 2009). Although most of this work focusses on girls, following trends in the wider literature on early sexual development (Roberts 2015), studies show that both internationally and locally adopted boys and girls are over-represented in clinical populations of early developers (Bourguignon et al. 1992; Kempers and Otten 2002; Soriano-Guillén et al. 2010; Brooker et al. 2012). Risk of early development in one Danish study increased for children adopted when they were older than 2 years (uncertainty about the exact ages of adopted children was taken into account) and differed according to birth country (Teilmann et al. 2006). This

finding holds significance in relation to forms of early care: Teilmann *et al.* (2006: 392) found that children from South Korea who had lived in foster homes rather than orphanages were *not* more likely to experience early puberty.

All of these papers report uncertainty about the causes of early puberty in this group of children: nutritional and related weight changes and changing exposure to environmental toxins are floated as possible factors, as is stress and early trauma (Parent *et al.* 2003, 683). Arguments are troubled by the lack of parity in pubertal timing between adopted children and those migrating with their parents: whilst some studies show that the children of migrating families moving from underdeveloped to developed countries may also be at increased risk of early puberty (Parent *et al.* 2003, 683); others find this is not the case (Soriano-Guillén *et al.* 2010) or only marginally so (Teilmann *et al.* 2006). Although exposed to similar changes in physical environment, non-adopted migrating children may not experience significant changes in diet because they are being cared for by the same people, who are better placed to maintain dietary continuity. More importantly, they remain with their birth families and may never have experienced the 'affective deprivation' that usually precedes adoption (Parent *et al.* 2003, 683).

So here we have a puzzle: although many scientists have worked on this issue, there is no consensus about why adopted children might enter into puberty earlier than is typical for their non-adopted peers. Stress seems to be important, although toxins and nutrition may also be involved. This connection between stress and puberty is particularly fascinating to me. As an adoptive parent, I have spent a lot of time reading, thinking and sometimes writing about the physical, social and emotional challenges faced by many adopted children and their families. Early sexual development is a relatively minor issue in this field of troubles to be sure, but understanding (so as to better live with) the psycho-physiological half-lives of early trauma is our daily core business. In the face of enduring and somewhat contagious distress, (often felt and expressed physically), what most adoptive parents are looking for, it seems to me, is an answer to the question: how can we convince our children's mind-body that they are now safe and that it is ok to enter a positive relationship with us? And, perhaps even more importantly, how can we regulate our own reactions to our children's distress in order to keep looking after them well?

Trying to find answers to these questions, adoptive parents are increasingly lead – by social workers, psychologists and support organisations – towards neuroscientifically

informed therapeutic literatures promoting ‘brain-based’ or ‘attachment-focussed’ parenting; a set of practices in which we are encouraged to consider the biological processes underlying ‘challenging behaviour’ (Mackenzie and Roberts, in review). These literatures describe children’s and adults’ brains as the materialisations of evolutionary and individual histories. Human brains, we learn, are tri-partite: constituted by ‘primitive’ or ‘reptilian’ elements that come into operation in situations of fear and rage; ‘mammalian’ elements that allow for relational sociality; and ‘more advanced’ cortical structures that facilitate considered action and cognition. But brains also bear the scars of individual life experience. A child or parent who has experienced early neglect or abuse will react in particular ways to life stressors because their brain is ‘wired differently.’

There is much to say, of course, about this literature and the contemporary shift to brain-based accounts of parenting and child behaviour. Here I want to stick with the more focussed question: how might we understand the relationship between infant and/or childhood stress and early sexual development?

### **Evolutionary theories of parenting**

In a short article published in 2013 in *Feminist Theory’s* special issue on ‘feminisms, “sexualisation” and contemporary girlhoods’, I discussed some evolutionary psychology (EP) research on this topic (Roberts 2013). Somewhat nervously – worried about being accused of biologism or aligning myself with regressive politics – I explored what, if anything, might be helpful for feminism in this literature. Does evolutionary psychology have anything useful or interesting to say about the effects of early stress on the timing of sexual development?

As I explained in more detail there, in 1991 three American scientists, Jay Belsky, Laurence Steinberg and Patricia Draper, proposed an ‘evolutionary theory of socialization’ arguing, in a nutshell, that poor early care means children live with bodily perceived danger and become unable to assume their own survival. The bodies of these children, they suggest, consequently prioritise reproducing as soon as possible: the physiological drive to procreate takes precedence over care of the self or of others (including offspring)(Belsky, Steinberg, and Draper 1991). The body of the early developing child, in other words, is preparing to reproduce before dying. Belsky, Steinberg and Draper link this to existing evolutionary psychology research on ‘parental investment,’ arguing that children who

experience poor parenting are also less likely to invest much in their own children, prioritising number of offspring over the quality of relationships with them (Belsky, Steinberg, and Draper 1991, 652). They also make claims about the sexually differentiated nature of these processes, suggesting that hormonal differences effect the behaviours and physical development of girls and boys differently as they begin puberty and enter reproductive sexual relationships (Belsky, Steinberg, and Draper 1991, 653).

As I argue in my piece in *Feminist Theory*, this theory assumes much about the nature of families and the naturalness/ necessity of enduring heterosexual reproductive relationships. In line with other critiques of evolutionary psychology then, I want to challenge Belsky, Steinberg and Draper's underpinning assumption that it is 'best' for children to grow up in two-parent heterosexual families. The sociological literature on parenting clearly demonstrates that there are some advantages to growing up in lesbian families, for example, and that the sex/gender and sexual orientations of parents and carers has little impact on children's psychological and physiological well-being (the work of Susan Golombok explores this in detail). The emphasis on 'present' fathers seems to both naturalise a patriarchal account of family life that is less and less socially valued, and to (often-wrongly) assume that children living in households without fathers do not have men actively involved in their lives.<sup>i</sup>

Belsky, Steinberg and Draper's theory was developed before the literature on adopted children appeared. In more recent work with Hochberg, however, Belsky does note the literature on international adoption, arguing that adopted children's development constitutes 'an adaptive response' to their improved life situation and claiming a sexual difference in the 'fitness advantage' offered by early development (which for them explains the higher preponderance of early developing girls):

Modern hygiene and medicine have influenced nutritional and infectious constraints on puberty, resulting in the secular trend in pubertal development over the past 150 years... Further evidence to this effect would seem to come from research showing that girls and, to a lesser extent, boys adopted from developing to industrial countries show accelerated sexual development. The greater tendency of adopted girls to respond with pubertal onset to a changing environment is in line with female preponderance of idiopathic central precocious puberty. As noted earlier, it is the female who has intrinsic constraints on the number of offspring she can generate over

her reproductive years, and it is females more than males who may enjoy a fitness advantage from early maturation. Thus, *evolutionary life-history thinking challenges the notion that earlier puberty is the result of a hypothalamic control malfunction, viewing it rather as an adaptive response to improving life conditions, similar to that witnessed in the case of the secular trend* (Hochberg and Belsky, 2013; emphasis added).

This account of early puberty as a response to positive change is at odds with the emphasis on stress and danger in the earlier work of Belsky *et al.* Using the language of evolution to describe early sexual development as an ‘adaptive response’ obscures the well-documented stress experienced by adopted children, rendering adoption an unalloyed ‘good.’ In contrast, and in learning from my own experience of contemporary adoption, I want to keep open the question of early trauma’s effect on brain-bodies and interpersonal human relations.

### **The Polyvagal Theory**

Attempting to explore the embodied nature of trauma without resorting to simplified understanding of either adaption or adoption, I have recently become interested in ‘polyvagal theory.’ Developed by American psychiatrist Stephen Porges, polyvagal theory stands at a deliberate distance from psychology as a discipline, despite sharing evolutionary psychology’s concerns with the history of the brain and the relationship between behaviour and neurophysiology (Porges 2011). I first encountered Porges’ work in a book co-authored by Daniel Hughes and Jonathon Baylin, American psychologists specialising in the treatment of traumatised children and their families (Hughes and Baylin 2012). Hughes and Baylin use polyvagal theory to explain the physiology and behaviour of neglected and abused children and their parents. Resonating with earlier Darwinian work on affect, they focus in particular on the ways in which brain states (which Porges would theorise as responses of the polyvagal system) are expressed facially.

Porges is interested in emotions and argues that they should not be psychologised but rather understood as psychophysiological: fear, for example, is increased heart rate and blood pressure, sweating, changes to digestion, the dilation of bowels etc, *not the result or the cause of these experiences*. His research focusses on the vagus: a branching set of nerves connecting the brainstem to the parts of the body (e.g. heart, face, middle ear, skin and

digestive tract) involved in our autonomous nervous systems. These are the systems in charge of what we are not in conscious control of most of the time: digesting, sweating, excreting, heart-rate, breathing. The vagal system, Porges suggests, is many-stranded or 'poly' and is oriented towards physiological survival.

Linking the brain not only with the heart but also the digestive tract, facial muscles (involved in smiling, chewing, sucking and swallowing) and the middle ear (affecting hearing), the vagus unconsciously messages danger in response to certain situations and signals: Porges calls this 'neuroception.' These messages activate fight or flight responses in the first instance and 'play dead' (what he calls 'immobilisation') responses if these do not work. These two responses, Porges argues, are evolutionarily hierarchical: 'play dead' or immobilisation is an ancient defence tactic, favoured by reptiles, that arises in the brainstem. In humans it involves decreased heart rate, lower cortisol levels, depression and emotional 'shutdown'. Fight or flight is a somewhat later (more 'advanced') response, utilised in preference by mammals, for whom 'playing dead' can apparently sometimes cause their own death. This set of responses is regulated in the hypothalamic-pituitary-adrenal (HPA) axis and involves increased heart rate and higher cortisol, anxiety, panic and rage. In everyday life, the theory goes, we unconsciously make judgements about safety through neuroception – assessing the facial expressions, voice tone and behaviour of others and responding accordingly.

Porges argues that mammals - and primates are outstanding in this - also have a 'vagal brake' (the so-called 'myelinated vagus') that allows us to socialise or 'socially mobilise' or 'social engage' to use his language. Because the vagus links basic functions such as swallowing, breathing, heart rate, hearing and facial movements, applying the vagal brake materialises in responsive (rather than flat) facial expressions, calmer breath and increased capacity to listen to others. These behaviours help to calm others. If we feel safe enough, the vagal brake prevents the two defensive responses of flight or fight or immobilisation so we can engage with others socially, sexually and in care relations (parenting or being parented).

Importantly for my argument here, Porges reports that physiological measurements relating to what he calls 'vagal tone' (the ability to apply the 'vagal brake' appropriately) find that because vagal tone develops through interpersonal relations, children who experience early care that does not provide basic physiological and/or psychological safety stand out

from their age peers. Such children often react in ‘fight or flight’ mode to neutral or even caring situations (expressing rage, attacking carers or running away) and can also become immobilised much more easily than their peers (Porges 2011, Chapter 12). This argument is supported by the psychological literature on adopted children, which suggests that children who have experienced early trauma are more likely to (mis)read neutral or mildly disapproving faces or vocal tones as hostile and to react with rage or freezing (becoming unable to look at their parents’ faces for example) to what seem like minor triggers to others; a cross tone of voice, a minor act of aggression by another child, a particular look or smell (Hughes and Baylin 2012). Poor vagal tone is also associated with particular hormonal profiles (e.g. high cortisol) and atypical reactivity to stress (Porges 2011, 142–147).

The concepts of vagal tone and neuroception have significance for therapeutic interventions. In a chapter on the efficacy of music therapy compared to psychotherapy for traumatised individuals, for example, Porges argues that traditional face-to-face encounters may trigger a threatened response, whilst music may provide ‘an alternate portal to the social engagement system’ (Porges 2011, 251). He explains:

Attempts to socially engage a traumatized individual [e.g. through prosodic speech and interested gaze], rather than calming, may result in defensive strategies of rage and anger. Life threat triggers a very ancient neural circuit that severely limits social engagement behaviors and may distort neuroception, resulting in a false detection of risk (Porges 2011, 251).

Importantly, expressions of rage and anger are likely to provoke anxiety and fear in others. Both therapeutic and parenting encounters, in this model, would be helped by attending to the psychophysiological processes of both therapist/parent and client/child in order to increase psychophysiological perceptions (neuroceptions) of safety.

As far as I know, Porges has not addressed the question of pubertal timing in his research. *What I take from his polyvagal theory, however, is that we don’t need to tell stories about absent fathers or reinforce patriarchal myths about good and bad families to think about the mutual intertwining of social, psychological and physiological life.* I still don’t know why adopted children might develop earlier, but I am guessing that the vagus has something to do with it. The bodies of children living with chronic fear or unsafety are frequently in atypical state in which, as Belsky, Steinberg and Draper also claim, survival seems to be in jeopardy. This experience of danger will train the vagus to react in particular

ways to social encounters, and such reactions will become part of the child's life and relationships. How these patterns of vagal tone relate to sexual development clearly requires careful, critical research. To be clear, my suggestion is not that the timing of sexual development is biologically determined in some simplistic way: to the contrary, I am arguing that polyvagal theory might help us better understand how early life experiences might become embodied, enduring (but not unchangeable) patterns of interaction with others.

Like all scientists interested in evolutionary timescales, Porges assumes that sexual reproduction is an important orientation in social life, but unlike Belsky, Steinberg and Draper he does not argue that it takes priority over survival. This is one area in which his views differ from those of mainstream evolutionary psychologists. To be sure, Porges' theorisation of sexuality is at first glance not very feminist-friendly. He argues that sexual intercourse requires what he calls 'immobilisation without fear' on the behalf of women (playing dead so you can be penetrated?) and that good vagal tone is thus necessary to an enjoyable sex life. There is much to be said, then, about his normative understandings of sexuality. The key point I want to make here, however, is that the connection Porges makes between early stress (poor vagal tone) and early development is not about prioritising sex over life *but something far more complex in the relationship between fear, embodiment and social and sexual engagement*. It is this complexity that for me suggests a more interesting set of possibilities for feminist engagement than the original Belsky, Steinberg and Draper theory or Belsky's more recent claims about early puberty as an adaptive response to improved life situations.

## **Conclusion**

In *Puberty in Crisis* I suggest that we approach puberty as a bio-psycho-social process. Evolutionary psychologists and neuropsychiatrists like Porges would be unlikely to appreciate the focus on text, mediation and cultural meaning in the book's account of this process: they prefer to study 'universal' human traits rather than cultural specificities and to focus on evolutionary rather than social or historical time. Perhaps the twain shall never meet on those key points. Despite this, and learning from the work of feminist developmental biologist Anne Fausto-Sterling and colleagues (Fausto-Sterling, Coll, and Lamarre 2012a; Fausto-Sterling, Coll, and Lamarre 2012b), I want to more optimistically

suggest that there is potential critical synergy between feminist work on the body-as-lived and scientific accounts of emergent body-brain systems such as the polyvagal theory.

Scientific theories addressing the formative role of early experience may help us both to theorise the entanglement of 'the social' and the flesh (and hence the malleability of bodies and subjectivities) and to understand the intense resistance we encounter when trying to achieve psychological or physiological change (vagal tone, Porges argues, does not respond well to talk or reason – it requires other forms of bodily intervention such as music therapy as well as conscious awareness of our physiological responses to danger). Using evolutionary scientific arguments in this way, be it Porges' polyvagal theory or Belsky et al.'s account of sexual development, is, I recognise, to more or less mess with what the scientists intend. As Suzanne Kelly argues in a recent paper in *Dialectical Anthropology*, evolutionary psychology would have to change a lot to align itself with contemporary feminist theories of the body, including giving up essentialist accounts of sexual difference and normative assumptions about sexual activities, sexual reproduction and parenting (Kelly 2014).

Despite this, I want to suggest that feminists share with some of these theorists – and perhaps Porges in particular – an expressed desire to push at conventional distinctions between the social, the psychological and the biological/ physiological. Critically engaging with scientific work on the neurophysiology of behaviour may provide feminists with interesting new tools with which to open up these limiting dichotomies and to speak back to the more troubling arguments of evolutionary psychology. We may also sometimes share political goals in developing these lines of thought: helping adopted children and their parents to live better with the half-lives of early trauma might be one of those, as might trying to understand, or even to stem, a downward shift in pubertal timing. This is not to suggest any lessening of the important feminist tradition of criticism of scientific theories that make reductive claims about sex/gender or of the oppressive ways in which scientific theories are sometimes taken up in the service of regressive politics. Rather it is to continue the related tradition of feminist scholarship – in which Australian scholars and this journal have played a hugely significant role – of trying to think seriously about the body as situated, material and relational, that is, as bio-psycho-social.

## **Bibliography**

- Belsky, Jay, Laurence Steinberg, and Patricia Draper. 1991. "Childhood Experience, Interpersonal Development, and Reproductive Strategy: An Evolutionary Theory of Socialization." *Child Development* 62 (4): 647–70.
- Bourguignon, J P, A Gérard, M L Alvarez Gonzalez, L Fawe, and P Franchimont. 1992. "Effects of Changes in Nutritional Conditions on Timing of Puberty: Clinical Evidence from Adopted Children and Experimental Studies in the Male Rat." *Hormone Research* 38 Suppl 1: 97–105.
- Brooker, Rebecca J., Sheri A. Berenbaum, Josh Bricker, Robin P. Corley, and Sally A. Wadsworth. 2012. "Pubertal Timing as a Potential Mediator of Adoption Effects on Problem Behaviors." *Journal of Research on Adolescence* 22 (4): 739–45.
- Fausto-Sterling, Anne, Cynthia Garcia Coll, and Meghan Lamarre. 2012a. "Sexing the Baby: Part 1—What Do We Really Know about Sex Differentiation in the First Three Years of Life?" *Social Science & Medicine* 74 (11): 1684–92.
- Fausto-Sterling, Anne, Cynthia Garcia Coll, and Meaghan Lamarre. 2012b. "Sexing the Baby: Part 2 Applying Dynamic Systems Theory to the Emergences of Sex-Related Differences in Infants and Toddlers." *Social Science & Medicine* 74 (11): 1693–1702.
- Fausto-Sterling, Anne, Patricia Adair Gowaty, and Marlene Zuk. 1997. *Evolutionary Psychology and Darwinian Feminism*. 23 (2): 403–417.
- Hughes, Daniel A, and Jonathan F Baylin. 2012. *Brain-Based Parenting: The Neuroscience of Caregiving for Healthy Attachment*. New York: W.W. Norton & Co.
- Kaplan, Gisela T, and Lesley J Rogers. 2000. *The Orangutans*. New York: Basic Books.
- Kelly, Suzanne. 2014. "Tofu Feminism: Can Feminist Theory Absorb Evolutionary Psychology?" *Dialectical Anthropology* 38 (3): 287–304.
- Kempers, M J E, and B J Otten. 2002. "Idiopathic Precocious Puberty versus Puberty in Adopted Children; Auxological Response to Gonadotrophin-Releasing Hormone Agonist Treatment and Final Height." *European Journal of Endocrinology* 147 (5): 609–16.
- Mul, D., W. Oostdijk, and S. L. S. Drop. 2002. "Early Puberty in Adopted Children." *Hormone Research in Paediatrics* 57 (1-2): 1–9.
- Parent, A.-S. 2003. "The Timing of Normal Puberty and the Age Limits of Sexual Precocity: Variations around the World, Secular Trends, and Changes after Migration." *Endocrine Reviews* 24 (5): 668–93.
- Parent, AS, G Teilmann, A Juul, NE Skakkebaek, J Toppari, and JP Bourguignon. 2003. "The Timing of Normal Puberty and the Age Limits of Sexual Precocity: Variations around the World, Secular Trends, and Changes after Migration." *Endocrine Reviews* 24 (5): 668–93.
- Porges, Stephen W. 2011. *The Polyvagal Theory: Neurophysiological Foundations of Emotions, Attachment, Communication, Self-Regulation*. New York and London: W.W. Norton & Co.
- Roberts, C. 2013. "Evolutionary Psychology, Feminism and Early Sexual Development." *Feminist Theory* 14 (3): 295–304.
- Roberts, Celia. 2015a. *Puberty in Crisis: The Sociology of Early Sexual Development*. Cambridge: Cambridge University Press.
- Soriano-Guillén, Leandro, Raquel Corripio, José Ignacio Labarta, Ramón Cañete, Lidia Castro-Feijóo, Rafael Espino, and Jesús Argente. 2010. "Central Precocious Puberty in Children Living in Spain: Incidence, Prevalence, and Influence of Adoption and Immigration." *Journal of Clinical Endocrinology & Metabolism* 95 (9): 4305–13.

- Teilmann, Grete, Carsten B. Pedersen, Niels E. Skakkebaek, and Tina Kold Jensen. 2006. "Increased Risk of Precocious Puberty in Internationally Adopted Children in Denmark." *Pediatrics* 118 (2): 391-99.
- Teilmann, Grete, Jørgen H Petersen, Magdalena Gormsen, Karen Damgaard, Niels E Skakkebaek, and Tina Kold Jensen. 2009. "Early Puberty in Internationally Adopted Girls: Hormonal and Clinical Markers of Puberty in 276 Girls Examined Biannually over Two Years." *Hormone Research* 72 (4): 236-46.
- Viridis, R., M. E Street, M. Zampolli, G. Radetti, B. Pezzini, M. Benelli, L. Ghizzoni, and C. Volta. 1998. "Precocious Puberty in Girls Adopted from Developing Countries." *Archives of Disease in Childhood* 78 (2): 152.

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<sup>1</sup> These kinds of arguments about the complexities of life (as opposed to the simplified normative assumptions of evolutionary psychologists criticised by others in this Special Section) resonate with feminist work on animal reproduction which finds, for example, that female birds and primates are selective in mate choice and that so-called 'alpha males' are not always the biological fathers of the young conceived in their territories of 'control' (Fausto-Sterling, Gowaty, and Zuk 1997; Kaplan and Rogers 2000).