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1. CHANGING OUR MINDS

The Developmental Potential of Threshold Concepts

INTRODUCTION

In writing this chapter, I have to come to a startling personal revelation: I am a philosopher, if only an amateur one. Perhaps this revelation should not be so startling, for I have always been a lover (*philo*) of wisdom (*sophia*). And I am, after all, in the process of completing a doctor of philosophy degree.

At the heart of a philosopher's approach lies the activity of asking questions. Gaarder (1994) explains, however, that philosophers are generally not captivated by the entire realm of philosophical questions, yet have particular queries with which they are especially concerned. Therefore, philosophers' questions provide valuable insight into their philosophical *projects.*

What, then, is my philosophical project? Broadly, in my work, I am intrigued by questions about learning in higher education. At the beginning of each project, I therefore return to the question 'What is learning?' for I realise that my interpretation lies at the heart of all subsequent thinking. Here, I adopt the perspective that *learning is an active process of meaning-making* (e.g., Anderson and Krathwohl, 2001; Belenky, Clinchy, Golberger, and Tarule, 1986/1997; Kegan, 1982; Perry, 1970). The question that follows, then, is 'How does learning happen?' Indeed, learning is often characterised as a developmental process. In his Constructive-Developmental Theory of Meaning-Making, Robert Kegan (1982) elegantly weaves together the notions of meaning-making and development, and posits that individuals' abilities to construct meaning evolve through regular periods of stability and change throughout their lifespan.

It is these periods of change, these transitions that characterise the learning process, which I find most intriguing. These transitions remain nebulous; however, understanding them is crucial. Cross (1999) notes that 'in developmental theory, the periods of greatest personal growth are thought to lie in the unnamed and poorly-defined periods *between* stages' (p. 262; emphasis in original). We might therefore imagine that the most significant aspect of learning lies not in the *outcomes* of learning, but in the *process* of learning. Understanding this process and how best to facilitate it is thus essential to our work as educators.

How fortunate, then, that we may now turn to the growing body of literature on threshold concepts for, in their identification of threshold concepts, Meyer and Land (2003) appear to have captured the inherently developmental nature of these

trajectories of learning. Indeed, Perkins (2007) notes that threshold concepts are 'especially pivotal to a stage-like advance in understanding a discipline' (p. 36). The focus of my current project is therefore to examine issues central to threshold concepts, such as 'liminality,' and to explore the characteristics used to describe threshold concepts, such as 'troublesome,' 'transformative,' 'irreversible,' 'integrative,' and 'bounded' in light of developmental principles in order to help us better understand the complex nature of the learning process.

In exploring the characteristics of threshold concepts from a developmental perspective, we begin to capture a sense of the work that threshold concepts are doing: they are transforming, integrating, making trouble, but of what? Thus, the question remains as to *what* is changing and allowing us to remark that a threshold has been crossed, that a transformation has occurred, that a learner has moved from one stage, one way of making meaning to the next?

Indeed, what we are witnessing, experiencing, or contributing to is the transformation of the *essence* of a particular position or stage from which meaning of the world is constructed. Kegan (1982) theorises that at the heart of a stage of meaning-making is a way of knowing, an epistemology, which shapes the 'window or a lens through which one looks at the world' (Kegan, with Debold, 2002, p. 3). While we will return to the question of essence later, here, I wish to emphasise that the great value of threshold concepts is that they serve to instigate a process of 'epistemological transitions' (Meyer and Land, 2005, p. 386); that is, transitions not only in *what* learners know, but in *how* they know; transitions that may provide a 'transformed internal view of subject matter, subject landscape, or even world view' (Meyer and Land, 2003, p. 1). This chapter is therefore an attempt to capture and qualify the transitional process instigated by threshold concepts and explore its potential influence on our practice as educators.

UNDERLYING ASSUMPTIONS

Many questions remain to be investigated in our exploration of the developmental nature of threshold concepts, questions such as 'How might a developmental perspective be used to explain variation in learners' responses to threshold concepts?', 'What is the relationship between learning and development?', and 'How might troublesomeness be developmentally productive?'. I would now like to comment briefly on the approach I will take to answering these questions.

One of my fundamental assumptions is that questions are best approached from what I qualify as an *integrationist* approach. As people trained or training to become disciplinary experts, we may so easily become mired in our own contexts that we may fail to consider that the questions about which we feel so passionate are the same questions that intrigue our colleagues in other fields. The question of thresholds and the processes and mechanisms which drive development towards and across thresholds are not only questions of educational psychology (my own field), but also those of the fields in which educational psychology is rooted: philosophy, biology, and psychology. Consequently, in my attempt to situate the characteristics of threshold concepts within a developmental framework, I draw on

Kegan's (1982) interdisciplinary Constructive-Developmental Theory, as well as on work in these other fields, searching for the deeper principles of development that at once underlie, transcend, and thereby unify our specific contextual concerns.

In my exploration, I will also attempt to capture the *simultaneously cognitive and affective* nature of these epistemological transformations. While cognitive processes are often emphasised in accounts of learning, the affective nature of these transitions is often minimised, denigrated, or altogether ignored. Consequently, the appeal of Kegan's Constructive-Developmental Theory (1982) is its acknowledgement of 'the equal dignity' (p. 107) of cognition and affect. It is a theory that recognises that 'we are [evolutionary] activity and we experience it' (pp. 81–82). As we will see later, this conceptualisation has deep implications for the ways in which we view the process of epistemological transformation triggered by threshold concepts.

Thank you for reading. Now let us begin addressing some of our questions.

PRELIMINAL VARIATION, OR, ON BALANCE

A powerful image that Kegan (1982) uses to guide our understanding of the evolution of stages or 'orders' of meaning-making is that of *balance*. Two intriguing questions now emerge: 'How might the notion of balance contribute to our understanding of the learning process?' and 'Might the notion of balance help us account for variation in learners' responses to the process of transformation instigated by threshold concepts?'.

The language of balance permeates our daily lives: we are concerned with maintaining balance in the world's ecosystems, balancing our diets, and finding work-life balance. This concern may be traced to ancient times, where cultural myths reveal that people sought ways to preserve the balance between 'the forces of good and evil' (Gaarder, 1994, p. 25). Hippocrates believed that 'when sickness occurs, it is a sign that Nature has gone off course because of physical or mental imbalance' and that "that the road to health for everyone is through moderation, harmony, and a 'sound mind in a sound body'" (Gaarder, 1994, p. 56). With respect to our cognitive development, Piaget proposes equilibration as a process through which balance is sought by integrating interactions between the organism and the environment (Ferrari, Pinard and Runions, 2001; Piaget, 1950).

What we are balancing, in fact, is *essence*. The question of essence also concerned the earliest Greek philosophers. Gaarder (1994) explains that there existed a shared belief that 'nothing comes from nothing' (p. 41). Parmenides, for example "had refused to accept the idea of change in any form. […] His intelligence could not accept that 'something' could suddenly transform itself into 'something completely different'" (p. 41). This, then, was the 'problem of change,' the question of 'How could one substance suddenly change into something else?' (Gaarder, 1994, p. 35).

The assumption, therefore, was that "'something' had always existed" (Gaarder, 1994, p. 33). And by examining the notion of essence, we address the question of precisely what is emerging and being organised into qualitatively different (e.g. Kegan, 1982; Lewis, 2000; Schunk, 2000) and more complex forms.

In an edited volume entitled 'Reframing the Conceptual Change Approach in Learning and Instruction,' Baltas (2007) examines the notion of an essential 'something' changing in conceptual change. He states that

> the fact that […] 'something' remains invariant is faithfully reflected in the pertinent 'Eureka!' experience, for this is an experience that cannot engage but a single thing at both its ends: after having undergone it, we understand exactly what we were incapable of understanding before. (p. 66)

Baltas (2007) suggests that what we were incapable of understanding before were our background 'assumptions' (in quotation marks). These background 'assumptions', which 'were formlessly taken along as a matter of course and to which, accordingly, questions could not be addressed,' once disclosed, become assumptions (without quotation marks), that is, 'proposition[s] that can be doubted and thence conceptually and experimentally examined […] becom[ing] open to rejection, revision, justification, and so forth' (p. 66).

The notion of balance suggests that there must be more than one component to essence, and that some kind of tension must be resolved between opposites in order to obtain balance. And there is strong evidence in the philosophical, biological, and psychological literatures that supports the existence of opposites in our ideas, physiologies, and psyches. Saussure posits that 'binary opposites' characterise the structure of philosophical discourse; 'Anthropologist Claude Lévi-Strauss maintained that a system of binary codes operates in all cultures as their common logic' (Robinson and Groves, 2004, p. 160). Derrida's deconstructive approach to reading philosophical texts suggests the existence of 'multiple meanings at war with each other in the texts' (Robinson and Groves, 2004, p. 162). Biologists speak of 'evolution and its periods of adaptation – of life organisation – as involving a balance between differentiation and adaptation' (Kegan, 1982, p. 107).

In psychology, Erikson (1959) writes of the various shifts in balances between intimacy and isolation as individuals progress through young adulthood. Jung (1959) posits that our psyches are made up of numerous opposing spheres which we attempt to unite. He powerfully describes a pair of opposites as being 'one of the most fruitful sources of psychic energy' (p. 82). In their theories, Erikson and Jung also succeed in capturing how fundamentally unsettled we feel when our balance is threatened or disturbed. The resulting 'crises' (Erikson, 1959) and 'disequilibrium' (Jung, 1959) may be so powerful that they may lead to a feeling of 'being torn apart' (Magen, Austrian, and Hughes, 2002, p. 187).

Resulting from this process of interaction among opposites is not a static equilibrium, but what philosophers, biologists, and psychologists refer to as a *dynamic equilibrium* (e.g. Homeostatis, 2007; Kegan, 1982; Wood, 1998). This process of interaction among opposites continues throughout the ongoing course of development, and each stage consequently represents a qualitatively different and temporary 'evolutionary truce' (Kegan, 1982).

Kegan describes each truce as the coordination of the two essential elements of epistemology: what we view as 'subject' and what we view as 'object':

> What I mean by 'object' are those aspects of our experience that are apparent to us and can be looked at, related to, reflected upon, engaged, controlled, and connected to something else. We can be *objective* about these things, in that we don't see them as 'me.' But other aspects of our experience we are so identified with, embedded in, fused with, that we just experience them as ourselves. This is what we experience *subjectively* – the 'subject' half of the subject-object relationship. (With Debold, 2002, p. 3; emphasis in original)

Each new truce therefore discloses more of that in which we were embedded, thereby enabling us 'to listen to what before [we] could only hear irritably, and […] to hear irritably what before [we] could hear not at all' (Kegan, 1982, p. 105).

As educators, we must be acutely aware that the construction of meaning, the journey to each new truce, is both a cognitive *and* a deeply emotional venture for learners. Atherton (2008) tellingly writes of the 'cost' of learning, describing 'learning as loss' – the loss of a certain way of thinking about and being in the world. Boyd and Myers (1988) speak of the four phases of 'grief ' learners experience during a transformative learning process. William Perry (1981) also writes compellingly of the emotional upheavals involved in the developmental process:

> I have remarked elsewhere (Perry, 1978) on the importance we have come to ascribe to a student's 'allowing for grief ' in the process of growth, especially in the rapid movement from the limitless potentials of youth to the particular realities of adulthood. Each of the upheavals of cognitive growth threatens the balance between vitality and depression, hope and despair. It may be a great joy to discover a new and more complex way of thinking and seeing; but yesterday one thought in simpler ways, and hope and aspiration were embedded in those ways. Now that those ways are left behind, must hope be abandoned too?

> It appears that it takes a little time for the guts to catch up with such leaps of the mind. (p. 108)

And, indeed, in the following section, we will explore some of the reasons why it may take our emotions some time 'to catch up with' our minds, and why our minds may be resistant to change in the first place.

Preserving Balance

Inherent in the notion of dynamic equilibrium explored earlier is the idea of *preserving* balance. Indeed, within both human biological and psychological systems, there is a strong tendency to maintain a state of equilibrium, which amounts, in some ways, to *resisting* the ongoing motion of development. Within the biological process of homeostasis, there exist states of dynamic equilibrium in

which the system in balance 'resists outside forces to change' (Homeostasis, 2007). As Kegan expresses more colloquially, there is a strong tendency to keep things 'pretty much as they are' (with Debold, 2002, p. 5).

In keeping things as they are, the human (organism) is, in fact, stating, 'I have boundaries that I do not want transgressed.' From a biological perspective, boundaries provide a crucial 'distinction between everything on the inside of a closed boundary and everything in the external world' (Dennett, 1991, p. 174). Dennett (1991) explains that this distinction 'is at the heart of all biological processes' and provides the powerful example of the immune system, 'with its millions of different antibodies arrayed in defense of the body against millions of different alien intruders. This army must solve the fundamental problem of recognition: telling one's self (and one's friends) from everything else' (p. 174).

Human psychological systems are equally adamant in their struggle to prevent change. In his theory of cognitive dissonance, Festinger (1957) explains that individuals attempt to achieve and maintain *consistency*, or *consonance*, between their knowledge, opinions, beliefs, and actions. Piaget's (1950) notion of assimilation captures the attempt to integrate experiences to existing cognitive structures. Perry (1970) notes that these assimilations 'tend to be implicit' (p. 42). That is, we tend to be unaware that they are occurring. Experiences are unconsciously integrated. Consequently, existing cognitive structures remain intact; the current perspective from which we view the world remains acceptable; balance is preserved.

Kegan (with Scharmer, 2000) remarks that these balances are very 'hardy,' (p. 11) particularly during adulthood. It becomes more and more difficult for experiences to undo this balance, to break through a boundary, to 'win through [our] increasingly complex defenses that have better and better ways of deluding us into the belief that we have grasped reality as it actually is' (Kegan, with Debold, 2002, p. 6). These balances are hardy because, 'assimilation is defense, but defense is also integrity' (Kegan, 1982, p. 41). The threat of change is a threat of *dis-integration*: the disintegration of a particular way of knowing that arises from the disclosure of one's assumptions or from disentangling oneself from that in which one was embedded. And if, as we saw earlier, emotion is an integral part of the process of change, there may be great *fear* in losing a self with whom one is familiar (Atherton, 2008; Berger, 2004; Taylor, 1995). In the face of new learning, this fear may reveal itself as a 'numbness,' where the learner may appear to be 'under an anesthetic' and as though 'suspended in time' (Boyd and Myers, 1988, p. 278).

It is not only fear and desire to preserve balance that prevent change, however. At times, people may have 'sincere, even passionate intentions to change'. Kegan explains that a recent medical study

> concluded that doctors can tell heart patients that they will literally die if they do not change their ways, and still only about one in seven will be able to make the changes. These are not people who want to die. They want to live out their lives, fulfill their dreams, watch their grandchildren grow up – and, still, they cannot make the changes they need to in order to survive. (With Carroll, 2007, p. 1)

In fact, Kegan and Lahey (2001) have labelled this tendency to resist change, even when faced the prospect of death, *immunity to change*. Kegan (with Carroll, 2007) describes their work as

> pay[ing] very close – and very respectful – attention to all those behaviors people engage in that work against their change goals […]. Instead of regarding these behaviors as obstacles in need of elimination, we take them as unrecognized signals of other, usually unspoken, often unacknowledged, goals or motivations. (p. 1)

Kegan refers to these goals and motivations as 'commitments,' and suggests that they may provide educators with rich insight regarding learners' unwillingness to change.

In our exploration of the notions of balance and preservation of balance, we have encountered several ideas that may help us account for why 'mental development is so often steadfastly invariant, so resistant to inspired pedagogy, so limited in transfer' (Bruner, 1997, p. 70). Indeed, learners' fears of giving up a sense of integrated selfhood, as well as commitments, either explicit or implicit, may help explain why learners get 'stuck' (Meyer and Land, 2003) or resist learning, particularly learning of the kind implied by the notion of threshold concepts, that is, learning of an epistemological transformational kind. These ideas suggest that variation in responses to threshold concepts may be linked to learners' readiness for change. That is, there may exist an 'optimal' or 'open period' during which a learner is most likely 'to respond to stimulation' (Kohlberg and Mayer, 1972, p. 490). Consequently, appropriately *timing* the introduction of threshold concepts might be an especially important consideration when designing learner-centred instruction.

TROUBLESOMENESS, OR, ON DISSONANCE

The discussion of variation in learners' responses to threshold concepts leads us to consider the following questions: What is the link between learning and development? Must development precede learning? Are learning and development synonymous? Does learning stimulate development? Vygotsky (1978) reviews these different positions and advances that 'the essential feature of learning is that it creates the zone of proximal development; that is, learning awakens a variety of internal developmental processes' (p. 90).

A logical next question is thus, 'What type of learning leads to development?'. While it is perhaps commonly believed that exposing learners to more and different types of experiences and information, or that 'teaching harder' (Perkins, 2007) will lead to development, the appropriate answer to this question may reveal a more qualitative than quantitative issue. Indeed exposure (even lots of exposure) does not guarantee that an organism will change in any significant way. In order for transformation to occur, learners must first perceive these experiences, knowledge, or phenomena to be 'dissonant' (Festinger, 1957), 'disorienting' (Mezirow, 2000), or what the literature on threshold concepts has come to qualify, 'troublesome' (Meyer and Land, 2003; Perkins, 1999).

Schunk (2000) remarks that 'the dissonance notion is vague' (p. 306). Work by Perkins, however, is doing much to elucidate this concept. His exploration of troublesome knowledge (Perkins, 2006) and theories of difficulty (Perkins, 2007), reveals a variety of reasons that may account for what makes certain sources of knowledge, including threshold concepts, particularly troublesome for learners. And, a deeper understanding of troublesomeness may reveal potentially powerful sources of transformation.

Both the biological and cognitive psychological literature suggest that, to promote development, phenomena must somehow be troublesome enough, inharmonious enough from existing structures, to disturb balance and lead the organism to actively respond (e.g., Festinger, 1957; Homeostasis, 2007). The purpose of this activity is to restore balance and, for humans, constitutes the very *making* of meaning.

Yet, with what actions do we respond to these instigators of change? To address this question, we must consider and acknowledge that, along with the cognitive experience of doubt, may come the emotional experience of self-doubt: the unsettling feeling that arises when one questions one's ways of seeing, of being in, the world.

While 'doubt is an uneasy and dissatisfied state from which we struggle to free ourselves and pass into the state of belief ' (Fisch, 1951, p. 59. In Murphy, 2003, p. 138), there is no guarantee that the state of belief will be a new one. It may, in fact be the already existing state of belief, as the tendency to preserve balance may still be strong at this time. That is, learners may choose to respond to epistemic doubt by 'ignor[ing] their feelings [...] because they feel so strongly about their current beliefs' (Bendixen and Rule, 2004, p. 75). Alternatively, they may experience a range of emotions, from 'a painful pining or yearning for that which has been lost to protest over the present situation' (Boyd and Myers, 1988, p. 278).

It is perhaps Perry (1981) who comments most eloquently on the 'deflections from growth' that might occur when learners become especially adamant in preserving balance even after the infiltration of doubt. He observes that being confronted with information and experiences revealing the inadequacy of their current belief system may not be sufficient to instigate growth in learners, and may, in fact, cause some to react with 'apathy,' 'anxiety,' 'depression,' and even educational 'cynicism' (p. 90). Learners may 'temporize;' that is, they may 'simply wai[t], reconsigning the agency for decision to some event that might turn up' (p. 90). Alternatively, they may 'retreat' to a former position (p. 91). Finally, they might 'escape.' Perry (1981) claims that it is during this period of escape that 'the self is lost through the very effort to hold onto it in the face of inexorable change in the world's appearance' (p. 92).

There are several implications of the above discussion on our interpretation of threshold concepts. First, if we accept that some degree of dissonance is often necessary to stimulate development, then the troublesome or 'nettlesome' (Sibbett and Thomson, 2008) nature of threshold concepts may be the very quality that reveals their developmental potential. Consequently, their power may be that they trigger dissonance not only at the cognitive and affective levels, but also dissonance

at the epistemological level, calling upon learners to 'change their minds,' not by supplanting *what* they know, but by transforming *how* they know. Furthermore, that learners respond to discrepancies in different ways, that is, by avoidance, assimilation, or, as we shall see, by accommodation (integration), suggests that there may exist highly individual reasons determining responses to threshold concepts, reasons such as alternative commitments and readiness for change. Finally, given the affective nature of these changes, our task as educators is to acknowledge the difficult journey on which we are asking students to embark. We may thus envision ways of foreshadowing for students the impending sense of loss and help them to live more comfortably with their discomfort.

TRANSFORMATIVENESS, OR, ON OPENING UP OF EPISTEMOLOGICAL, CONCEPTUAL, AND AFFECTIVE SPACES

Kegan (1982) notes that epistemic doubt may indeed lead one to 'the limits of [one's] ways of knowing the world' (p. 59), and, as we have seen, this may cause some learners to temporarily arrest their epistemic development. Yet, is this the response of most learners? Perry (1981) remarks that it is not. The response to epistemic doubt caused by troublesomeness may also take the form of action towards change, action marking the beginning of the transformative process, action which may 'open[…] up a new and previously inaccessible way of thinking about something' (Meyer and Land, 2003, p. 1).

The idea of 'opening up' new ways of thinking is captured in the work of many researchers interested in learning. Baltas (2007) characterises the disclosure of background 'assumptions' in conceptual change as 'widen[ing] up and modify[ing] […] the […] space available to inquiry' (p. 65). In their exploration of professors' developing conceptions of teaching, Entwistle and Walker (2002) characterise professors' sophisticated, learning-centred conceptions of teaching as 'lead[ing] to an expanded awareness – seeing additional goals for teaching and learning which were originally not perceived explicitly at all' (p. 17). Kegan (1994) eloquently notes that

> transforming our epistemologies, liberating ourselves from that in which we were embedded, making what was subject into object so that we can 'have it' rather than 'be had' by it – this is the most powerful way I know to conceptualize the growth of the mind. (p. 34)

We may therefore begin to envision that the transformative process involves not only the expansion of epistemological and conceptual spaces, but also, as Meyer and Land (2005, 2006) explain, the expansion and transformation of identity, of a learner's 'sense of self ' (2006, p. 19). We must also consider that this process of transformation, and hence movement within these liminal spaces, is not unidirectional, yet may 'involve oscillation between stages, often with temporary regression to an earlier status' (Meyer and Land, 2005, p. 376). Boyd and Myers (1988) speak of the 'oscillating movement […] from disorganization to despair' (p. 278) that characterises this phase of grieving in the process of transformational

education. Berger (2004) characterises transformational spaces as 'precarious', and Kegan (with Scharmer, 2000) describes entering into a transitional space as feeling much 'like going off a cliff ' (p. 11).

Yet, when standing on the edge of a cliff (or a threshold), might some learners feel terror, while others feel exhilaration? Stated otherwise, 'Does this liminal space feel the same for everyone?' In her thought piece entitled 'Dancing on the Threshold of Meaning: Recognizing and Understanding the Growing Edge,' Berger (2004) suggests that it might not. She recounts the stories of two women, Kathleen and Melody, both facing times of profound transition in their lives. Kathleen is 'excited […] and not knowing about her future leaves her filled with possibility and hope' (p. 341). Melody, on the other hand is both 'frighten[ed]' and 'unhappy' (p. 342) in this space of transformation. Berger's (2004) account of these two women, one who embraces the period of transition, and the other who retreats from it, provides evidence of a 'complex continuum' (p. 343) of emotional responses to the liminal space.

As we saw earlier, underlying this complex variation of individual responses may be issues of alternative commitments and readiness for change. What these issues may signal, in fact, is variation in learners' current ways of making meaning. Perry's seminal study entitled the 'Intellectual and Ethical Development of College Students' (1970) originated in an attempt to account for the variations he had observed in the ways in which college students were responding to the 'the pluralistic intellectual and social environment of the university' (Hofer and Pintrich, 1997, p. 90). What Perry ultimately showed was that different responses to external conditions could be attributed to individual differences in learners' epistemic beliefs. That some learners 'open up,' while others clearly get 'stuck' (Meyer and Land, 2005, p. 380), may signal to us as educators that the epistemological transition being instigated by a threshold concept lies *beyond* the learner's zone of proximal development (Vygotsky, 1978). That is, it lies too far beyond what the learner may achieve when guided by more skilful others. These variations in response to teaching caution us to be attuned to variations in the ways that learners are making meaning.

IRREVERSIBLITY, OR, ON CROSSING THRESHOLDS

Berger (2004) notes that "Bridges (1980) described as the hardest piece of trans-formation the 'neutral zone' when the past seems untenable and the future uniden-tifiable" (p. 343). That the past seems unreachable, suggests that the there is a time in the transformation process when the individual crosses a threshold.

The Oxford dictionary defines that a threshold 'symbolically […] marks the boundary between a household and the outer world, and hence between belonging and not-belonging, and between safety and danger' (Simpson and Roud, 2000) and consequently between the former world and the new world. In biology, a threshold indicates the minimum, yet critical level a stimulus must attain to 'produce excitation of any structure' (Therxold, 2000). Thus interpreted, the inherent troublesomeness of threshold concepts may provide the impulse that 'excites' an individual and leads to the type of action that carries him/her across a threshold towards epistemological transformation.

Might a learner revert to former ways of knowing after crossing a threshold? In characterising threshold concepts as 'irreversible,' Meyer and Land (2003) suggest 'that the change of perspective occasioned by the learning of a threshold concept is unlikely to be forgotten, or will be unlearned only by considerable effort' (p. 4). Baltas (2007) would call the impossibility of "forsaking the 'Eureka!' experience" and returning to previous ways of understanding an 'irreversible achievement' (p. 76). Thus, on a path of development from one way of knowing and meaning-making, one epistemic stage or stance to the next, there seems to exist a point in our journey when we cross a threshold and our old way of knowing is no longer 'tenable'. There is an irreversible shift in the way in which 'essence' is coordinated. There emerges a new space from which to observe and analyse the world.

Accompanying the new, however, is a loss of the old: old 'status,' old 'identity within the community' (Meyer and Land, 2005, p. 376), old ways of knowing, seeing, and being in the world. As we saw earlier, these liminal spaces where one is 'betwixt and between' ways of knowing are understandably deeply emotional, sometimes 'painful' (Boyd and Myers, 1988, p. 277; Love and Guthrie, 1999, p. 72), sometimes exhilarating. They are spaces where 'the individual is naked of self – neither fully in one category or another' (Goethe, 2003. In Meyer and Land, 2005, p. 376). Yet, this state of liminality does not as yet represent the new developmental stage, for, as Kegan (1982) reminds us, 'development is not a matter of differentiation alone, but of differentiation *and* integration' (p. 67; emphasis in original).

THE INTEGRATIVE NATURE OF THRESHOLD CONCEPTS, OR, ON INTEGRATION

The integration after differentiation of which Kegan (1982) speaks is the act of reorganising the essence of one's way of knowing into a new balance. And, as Lewis (2000) notes, self-organisation is a cross-scientific principle which 'explicates the emergence of order in physics, chemistry, biology, ecology, and cosmology' (p. 40). In describing threshold concepts as 'integrative,' and thereby 'expos[ing] the previously hidden interrelatedness of something', Meyer and Land (2003, p. 4) have captured the acts of reorganisation and accommodation (Piaget, 1950) that occur when individuals modify their existing cognitive structures to make sense of the external world. Perry (1970) remarks that these reorganisations are "sometimes […] sensed as a 'realization.' This is particularly likely in respect to an insight or reconstruction that suddenly reveals 'the' meaning of some incongruity of experience we have been trying for some time to make sense of " (pp. 41–42).

Meyer and Land's notion of integration is not purely cognitive, however, for it refers to the 'indissoluble interrelatedness of the leaner's identity with thinking and language' (2006, p. 21). The integrative nature of threshold concepts is thus also a matter of *integrity* – of the creation of a coherent way of knowing and being in the world. Boyd and Myers (1988) capture the emotion that characterises the final, integrative, phase of the grief work involved in transformational education as 'movement […] between a hope-filled sense of restabilization and reintegration of identity' (p. 279).

We may turn now to the 'newness' of what has emerged through qualitative change. Wood (1998) emphasises that 'the emergence of what is qualitatively new' may be 'understood in terms of the specific essence of that which is in process rather than in terms of general laws applying to simple elements of which it is composed' (p. 2). These qualitative reorganisations, perhaps precipitated by what Meyer and Land (2005) term the '*reconstitutive* effect of threshold concepts' (p. 375; emphasis added), represent the adaptation (e.g. Lewis, 2000) of an individual to his or her environment. And our very survival (biological, academic, or otherwise) depends on our ability to respond to the demands of our surroundings, to our 'life conditions' (Kegan, 1994).

Given the cognitive and emotional complexity involved in reorganising one's epistemic beliefs, Dole and Sinatra (1998) comment rather unsurprisingly that reorganisation is difficult to achieve. As educators and as disciplinary experts, we must consider that we may hold either explicit or implicit expectations regarding the 'appropriate' response or adaptation to the troublesomeness or discrepancy introduced by a threshold concept. Our upcoming discussion of the bounded nature of threshold concepts will urge us to consider, however, that these expectations may arise from the multiple layers of context in which threshold concepts are embedded.

BOUNDEDNESS, OR, ON CONSIDERING CONTEXT

The view of learning expressed in this chapter raises the interesting and ethical question of whether development should be the aim of education (e.g. Fiddler and Marienau, 1995; Kohlberg and Mayer, 1972). This question is important to consider because educational ideologies influence the nature of the outcomes established for and valued in learners (Kohlberg and Mayer, 1972). Moore (2002), commenting on the inherently developmental nature of learning, states that according to Perry and other researchers, 'true education, especially liberal arts education, was fundamentally about this kind of development – namely, the evolution of individuals' thinking structures and meaning making toward greater and more adaptive complexity' (p. 26).

Conceived of in this manner, the purpose of education is much less about fostering growth in *what* learners know than facilitating development of the *ways* in which they know. Such a perspective may partially allay Meyer and Land's (2005) concern about threshold concepts being perceived as prescribing a rigid, unidirectional path toward achievement of particular goals, such as degree achievement or professional accreditation. Focusing on threshold concepts' potential to instigate epistemological transformation enables us to emphasise learning as 'entrance into […] a community of people who share that way of thinking and practising' (Davies, 2006, p. 71).

While it may seem nobler to discuss the development of ways of knowing and being, rather than the content of knowing, as the aim of education, we must first clarify an important matter. The preceding discussion of essence and end points, of transitions, trajectories, and thresholds in the development of epistemic beliefs

reveals an additional underlying philosophical assumption, most notably that there is something orderly and progressive in the way that learners construct meaning in their disciplines and in their lives. Yet, this organismic (or modernist) worldview of development (Goldhaber, 2000) has historically been criticised by those holding contextualist (or post-modernist) views for its failure to integrate a deep consideration for the role played by context in development. In a fascinating illumination of the modernism – post-modernism debate, Chandler (1995) eloquently describes post-modernism's rebellion against modernism's ideas of universal stages and sequences in development. Indeed, some post-modernists claim that development is so entirely context-bound, and individuals' contexts so variable, that any attempt to search for universal patterns and endpoints in development is an attempt to perpetuate hierarchies and oppression. In his analysis of post-modern arguments against modern views of development, Chandler (1995) remarks, however, that

> while a certain incredulity toward the grand political narratives of the past may well be justified, the same suspicions may actually not be appropriate when attention is re-focused on those smaller potato matters having to do with the separate psychological development of individual persons. […] Many of post-modernism's hallmark questions concerning the essentially political consequences of modernity may actually be irrelevant to the job of deciding whether there is anything like human nature, or universal trajectories in the course of individual psychological development. (p. 8)

Chandler's thoughtful reflections on the post-modern view of development reveal a need for modernists to pay greater heed to the role played by context in development. Meyer and Land's (2003) discussion of threshold concepts as 'bounded' and thereby 'serv[ing] to constitute the demarcation between disciplinary areas' (p. 5) provides an excellent point from which to begin examining the issue of context and its relationship to our developmental perspective of threshold concepts. If, indeed, the learning of threshold concepts is ultimately a matter of epistemological transformation, we might consider the discipline and its inherent epistemology (Meyer and Land, 2005; Perkins, 1997) as only one of the multiple, interacting layers of (epistemic) context in which threshold concepts are embedded.

We might begin by considering, at the macro level, the powerful historical, social, and cultural forces that converge (Goldhaber, 2000) and give rise to the relative prominence of certain disciplines. We may then consider how these forces shape, at the meso level, the epistemic context of the discipline itself; that is, the questions pursued (and funded) and the methodologies judged as appropriate for pursuing them (Perkins, 1997). At the micro level, we may investigate how these forces manifest themselves in the selection by members of the disciplinary community of concepts deemed important, even thresholds, and around which curricula and programmes are designed. Finally, we must consider the ways of knowing and meaning-making of individual learners. Recent research reveals that the development of individuals' epistemic beliefs is shaped by these multiple layers of context (Palmer and Marra, 2008), as well as by more proximal influences, such

as religion and family (Gottlieb, 2007). We must therefore be prepared to accept variation in learners' cognitive and affective responses to our attempts to 'teach' threshold concepts.

The value of an approach that acknowledges the existence and influence of the multiple layers of interacting (epistemological) contexts in which threshold concepts are embedded allows us, in Kegan's terms, to make them 'object'. Consequently, rather than being impervious to their influence, we may hold them to light, examine them, and question their influence in shaping our current and future ways of knowing and being.

CONCLUDING THOUGHTS

With increased calls for accountability and the requirements of professional accreditation organisations, we must necessarily be concerned with, and attend to, the outcomes of learning in higher education. Indeed, we must have a clear vision of the direction in which we would like to take students. The questions raised in this chapter caution us, however, against making the acquisition of threshold concepts our sole focus as educators. We are perhaps reminded that increased attention to the learning *process* might help ensure that learners achieve the intended outcomes in a manner that recognises and respects the great cognitive and affective work they must do. Designing such developmentally-appropriate instruction involves having a deep understanding of learners' current ways of making meaning, for what we are facilitating is a process of epistemological transformation so crucial to learners' 'becoming': becoming disciplinary experts, and perhaps, most importantly, becoming more fully themselves.

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REFERENCES

Anderson, L. W., & Krathwohl, D. (Eds.). (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives*. New York: Longman.

Atherton, J. S. (2008). *Doceo: Learning as loss 1* [On-line] UK. Retrieved from http://www.doceo.co.uk/original/learnloss_1.htm

Baltas, A. (2007). Background 'assumptions' and the grammar of conceptual change: Rescuing Kuhn by means of Wittgenstein. In S. Vosniadou, A. Baltas, & X. Vamvakoussi (Eds.), *Reframing the conceptual change approach in learning and instruction* (pp. 63–79). Amsterdam, The Netherlands: Elsevier and the European Association for Research on Learning and Instruction (EARLI).

Belenky, M. F., Clinchy, B. M., Goldberger, N. R., & Tarule, J. M. (1986/1997). *Womens' ways of knowing* (2nd ed.). New York: BasicBooks.

Bendixen, L. D., & Rule, D. C. (2004). An integrative approach to personal epistemology: A guiding model. *Educational Psychologist*, *39*(1), 69–80.

Berger, J. G. (2004). Dancing on the threshold of meaning: Recognizing and understanding the growing edge. *Journal of Transformative Education*, *2*(4), 336–351.

Boyd, R. D., & Myers, J. G. (1988). Transformative education. *International Journal of Lifelong Education*, *7*(4), 261–284.

Bruner, J. (1997). Celebrating divergence: Piaget and Vygotsky. *Human Development*, *40*, 63–73.

Carroll, B. B. (2007). Overcoming the immunity to change: Robert Kegan [Electronic Version]. In *Harvard graduate school of education web site: Impact on the world: Stories of impact*. Retrieved June 22, 2007, from http://www.gse.harvard.edu/impact/stories/faculty/kegan.php

Chandler, M. (1995). Is this the end of 'the age of development,' or what? Or: Please wait a minute, Mr. Post-Man. *The Genetic Epistemologist*, *23*(1). Retrieved April 2, 2008, from http://www.piaget.org/GE/Winter95/ChandlerW95.html

Cross, P. (1999). What do we know about students' learning and how do we know it? *Innovative Higher Education*, *23*(4), 255–270.

Davies, P. (2006). Threshold concepts: How can we recognize them? In J. H. F. Meyer & R. Land (Eds.), *Overcoming barriers to student understanding*. Oxon, UK: Routledge.

Debold, E. (2002, Fall/Winter). Epistemology, fourth order consciousness, and the subject-object relationship or... How the self evolves with Robert Kegan. *What is Enlightenment?: Redefining Spirituality for an Evolving World*, *22*. Retrieved June 18, 2007, from http:www.wie.org/i2022/kegan.asp

Dennett, D. (1991). Chapter 7: The evolution of consciousness. In *Consciousness explained* (pp. 171–226). New York: Little, Brown and Company.

Dole, J. A., & Sinatra, G. M. (1998). Reconceptualizing change in the cognitive construction of knowledge. *Educational Psychologist*, *33*(2/3), 109–128.

Entwistle, N., & Walker, P. (2002). Strategic alertness and expanded awareness within sophisticated conceptions of teaching. In N. Hativa & P. Goodyear (Eds.), *Teacher thinking, beliefs and knowledge in higher education* (pp. 15–39). Dordrecht, The Netherlands: Kluwer Academic Publishers.

Erikson, E. (1959). *Identity and the life cycle: Selected papers*. New York: International Universities Press.

Ferrari, M., Pinard, A., & Runions, K. (2001). Piaget's framework for a scientific study of consciousness. *Human Development*, *44*(4), 195–213.

Festinger, L. (1957). *A theory of cognitive dissonance*. Evanston, IL: Row.

Fiddler, M., & Marienau, C. (1995). Linking learning, teaching, and development. In K. Taylor & C. Marienau (Eds.), *Learning environments for women's adult development: Bridges toward change* (Vol. New Directions for Adult and Continuing Education, 65, pp. 73–82). San Francisco: Jossey-Bass.

Gaarder, J. (1994). *Sophie's world: A novel about the history of philosophy* (P. Moller, Trans.). New York, USA: Farrar, Straus, and Giroux.

Goldhaber, D. E. (2000). *Theories of human development: Integrative perspectives*. Mountain View, CA: Mayfield Publishing Company.

Gottlieb, E. (2007). Learning how to believe: Epistemic development in cultural context. *Journal of the Learning Sciences*, *16*(1), 5–35.

Hofer, B. K., & Pintrich, P. R. (1997). The development of epistemological theories: Beliefs about knowledge and knowing and their relation to learning. *Review of Educational Research*, *67*(1), 88–140.

Homeostasis. (2007). [Electronic Version]. In *Encyclopædia Britannica*. Retrieved September 26, 2007, from Britannica Online Encyclopædia http://www.britannica.com/EBchecked/topic/270188/homeostasis

Jung, C. G. (1959). *The basic writings of C. G. Jung* (Violet Staub de Laszlo, Ed.). New York: Modern Library.

Kegan, R. (1982). *The evolving self: Problem and process in human development*. Cambridge, MA: Harvard University Press.

Kegan, R. (1994). *In over our heads: The mental demands of modern life*. Cambridge, MA: Harvard University Press.

Kegan, R., & Lahey, L. L. (2001). *How the way we talk can change the way we work: Seven languages for transformation*. San Francisco: Jossey-Bass.

Kohlberg, L., & Mayer, R. (1972). Development as the aim of education. *Harvard Educational Review*, *42*(4), 449–496.

Lewis, M. D. (2000). The promise of dynamic systems approaches for an integrated account of human development. *Child Development*, *71*(1), 36–43.

Love, P. G., & Guthrie, V. L. (1999). Kegan's orders of consciousness. *New Directions for Student Services*, *88*, 65–76.

Magen, R. H., Austrian, S. G., & Hughes, C. S. (2002). Chapter 5: Adulthood. In S. G. Austrian (Ed.), *Developmental theories through the life cycle* (pp. 181–263). New York: Columbia University Press.

Meyer, J. H. F., & Land, R. (2003). Threshold concepts and troublesome knowledge: Linkages to ways of thinking and practising within the disciplines. In C. Rust (Ed.), *Improving student learning: Improving student learning theory and practice – 10 years on*. Oxford, UK: Oxford Centre for Staff and Learning Development.

Meyer, J. H. F., & Land, R. (2005). Threshold concepts and troublesome knowledge (2): Epistemological considerations and a conceptual framework for teaching and learning. *Higher Education*, *49*(3), 373–388.

Meyer, J. H. F., & Land, R. (Eds.). (2006). *Overcoming barriers to student understanding*. Oxon, UK: Routledge.

Mezirow, J. (2000). Learning to think like an adult: Core concepts of transformation theory. In J. Mezirow (Ed.), *Learning as transformation: Critical perspectives on a theory in progress*. San Francisco: Jossey-Bass.

Moore, W. S. (2002). Understanding learning in a postmodern world: Reconsidering the Perry Scheme of intellectual and ethical development. In B. Hofer & P. Pintrich (Eds.), *Personal epistemology: The psychology of beliefs about knowledge and knowing* (pp. 17–36). Mahwah, NJ: Lawrence Erlbaum.

Murphy, P. K. (2003). The philosophy in thee: Tracing philosophical influences in educational psychology. *Educational Psychologist*, *38*(3), 137–145.

Palmer, B., & Marra, R. M. (2008). Individual domain-specific epistemologies: Implications for educational practice. In M. S. Khine (Ed.), *Knowing, knowledge and beliefs: Epistemological studies across diverse cultures*. The Netherlands: Springer.

Perkins, D. (1997). Epistemic games. *International Journal of Educational Research*, *27*(1), 49–61.

Perkins, D. (1999). The many faces of constructivism. *Educational Leadership*, *57*(3), 6–11.

Perkins, D. (2006). Constructivism and troublesome knowledge. In J. H. F. Meyer & R. Land (Eds.), *Overcoming barriers to student understanding*. Oxon, UK: Routledge.

Perkins, D. (2007). Theories of difficulty. *British Journal of Educational Psychology Monograph Series II* (4): Student Learning and University Teaching, 31–48.

Perry, W. G. (1970). *Forms of intellectual and ethical development in the college years: A scheme*. New York: Holt, Rinehart and Winston.

Perry, W. G. (1981). Cognitive and ethical growth: The making of meaning. In A. W. Chickering (Ed.), *The modern American college: Responding to the new realities of diverse students and a changing society* (pp. 76–116). San Francisco: Jossey-Bass.

Piaget, J. (1950). *The psychology of intelligence* (M. Piercy & D. E. Berlyne, Trans.). London, UK: Routledge & Paul.

Robinson, D., & Groves, J. (2004). *Introducing philosophy* (Original edition 1998 ed.). Cambridge, UK: Icon Books.

Scharmer, C. O. (2000, March 23). *Grabbing the tiger by the tail: Conversation with Robert Kegan, Harvard Graduate School of Education*. Retrieved July 25, 2007, from http://www.dialogonleadership. org/kegan-1999.html

Schunk, D. H. (2000). *Learning theories: An educational perspective* (3rd ed.). Upper Saddle River, NJ: Prentice Hall.

Sibbett, C., & Thompson, W. (2008, June 18–20). *Nettlesome knowledge and threshold concepts in higher education, organizational and professional cultures*. Paper presented at the 2nd International Conference on Threshold Concepts, Threshold Concepts: From Theory to Practice, Kingston, Ontario, Canada.

Simpson, J., & Roud, S. (2000). 'threshold'. In *Oxford reference online*: *A dictionary of English folklore*. Oxford University Press. Retrieved August 20, 2007, from http://www.oxfordreference.com/views/ENTRY.html?subview=Main&entry=t71.e1042

Taylor, K. (1995). Speaking her mind: Adult learning and women's adult development. In K. Taylor & C. Marienau (Eds.), *Learning environments for women's adult development: Bridges toward change* (Vol. New Directions for Adult and Continuing Education, 65, pp. 83–92). San Francisco: Jossey-Bass.

Therxold, A. S. (2000, March 5). 'threshold'. In *The online medical dictionary*. Department of Medical Oncology: University of Newcastle upon Tyne. Retrieved September 2, 2008, from http://cancerweb.ncl.ac.uk/cgi-bin/omd?threshold

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes* (Michael Cole Ed.). Cambridge, MA: Harvard University Press.

Wood, A. W. (1998). Dialectical materialism. In E. Craig (Ed.), *Routledge encyclopedia of philosophy*. London, UK. Retrieved September 25, 2007, from http://www.rep.routledge.com/article/N013SECT3

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