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Review Article

Deep Learning: Unconscious Cognition, the Intuitive Mind, and Transformative Language Learning

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Abstract

This article explores the notion of deep learning. Drawing on insights from cognitive neuroscience and educational psychology, it argues that an understanding of conscious and unconscious forms of cognition is important for language educators. It distinguishes between *surface learning*—that which engages primarily the analytic capacity and focused attention of the conscious mind, and *deep learning*—that which engages more out-of-awareness, more deeply embodied elements of cognition. An understanding of unconscious cognition is said to shed light on the process through which we learn complex skills—such as a foreign language. It also provides insight into the highly psychological nature of language learning. This article introduces a four-level model, based on dynamic skill theory, that helps conceptualize deep learning in terms of increasing levels of cognitive complexity, leading to intuitive knowledge and a more differentiated experience of the language learning process. It argues that an emphasis on deep learning leads to a more embodied and transformative view of learning, and a more holistic view of the learner.

Key words

Deep learning, Intuitive mind, Second language acquisition, Unconscious cognition

1. Two forms of knowing

Mastering a foreign language requires more than intellectual understanding. Unlike more purely academic subjects, such as history or science, foreign language mastery requires not only conceptual knowledge, but also a deeper learning process−one that involves trial and error practice, experimentation, interaction and self-expression. What may start as a purely intellectual exercise—the memorization of words and the study of grammatical rules—must be transformed and internalized into something more personal. It needs to become second nature to our way of thinking and acting—a creative medium through which we express our thoughts, feelings and identity. Once mastered in this way, a new language is no longer an academic subject or a body of knowledge—it has become part of the self.

Unfortunately, many learners never reach this deeper level of learning. One reason is that traditional approaches to foreign language pedagogy often

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focus on rote learning and intellectual understanding (Richards & Rodgers, 2014). Despite criticism, information-centered pedagogy remains common—with unfortunate consequences. In Japan, for example, 90 percent of adults report being dissatisfied with the English education they received in school (Benesse, 2006). Students report that they don't like studying English (Lafaye & Tsuda, 2002), and that they are demotivated by a heavy emphasis on vocabulary and grammar (Agawa et al., 2011).

There are many factors that contribute to an overemphasis on memorization and structural knowledge. One challenge is that pedagogy is grounded in how we conceptualize the language learning process. Do we see language learning as an additive process—like putting money in the bank of knowledge? Does memory work like a muscle that gets stronger through repeated flexing? Is language learning a puzzle that we solve before moving on to communicative practice? How does intellectual knowledge turn into the ability to use language spontaneously? Because the answers we give to these questions affect pedagogy and policy, educators need to reflect on their basic assumptions about language learning.

With this in mind, this article will reflect on our understanding of two contrasting forms of knowledge that are relevant to foreign language pedagogy: (a) intellectual knowledge that we can manipulate consciously in our mind and (b) the intuitive knowledge that allows for creative and spontaneous use of language. Language teachers talk about this distinction in a variety of ways: implicit vs. explicit knowledge, knowing vs. using; study vs. practice; and fluency vs. accuracy. They understand that these forms of knowing do not always work in parallel. Learners may have an intellectual grasp of language forms, yet struggle to express themselves freely. Others may have less linguistic knowledge, yet demonstrate more fluency or creativity in using the target language.

This article will explore these contrasting forms of knowing. It will draw on insights from the fields of cognitive neuroscience and educational psychology. It will argue that emerging insights into unconscious cognition should inform our understanding of language learning. A fundamental starting critique is that traditional foreign language pedagogy suffers from an overemphasis on *surface learning*—pedagogy that engages primarily the analytic capacity and focused attention of the conscious mind. It treats language learning as a purely mental task. Surface learning is distinguished from *deep learning*—which engages more out-of-awareness, more deeply embodied elements of cognition. Deep learning is seen as more transformative and psychologically challenging.

As we will see, the distinction between surface and deep learning is not simply metaphoric. It reflects two distinct constellations of cognitive function. An understanding of these cognitive processes helps us understand how we learn complex skills—such as a foreign language. It is also seen as more than the implicit acquisition of grammatical forms. The notion of deep learning draws attention to the highly psychological nature of language learning. In effect, learning a foreign language involves a restructuring of the cognitive architecture of the mind, and necessarily touches us at a very deep level of the self.

2. A deep learning perspective

Recent years have seen a revolution in our understanding of the brain and its cognitive processes (Hassin, Uleman, & Bargh, 2007). This is shedding light on many areas of cognition and mind, including decision-making, morality, psychological change, wellbeing, religious experience, rationality, empathy and consciousness. This article will examine the significance of this emerging body of work for language educators. It will argue that an understanding of unconscious cognition—the intuitive mind—is of

critical importance for language teachers. This perspective is part of a larger trend—the emergence of the field of educational neuroscience, which seeks to use brain and mind science to inform education (Cozolino, 2013; Sousa, 2010).

The main focus of this article is the notion of *deep learning*, a term that serves as a rubric for exploring language learning and the unconscious mind. This article first examines the concept of deep learning as used in education and computer learning. It then gives an overview of dual-processing models of cognition—the neurocognitive foundation for understanding the conscious and unconscious mind. It also looks at the overlap between the notion of deep learning, and related terms from second language acquisition research. The article then focuses on the implications of the deep learning perspective. These are divided into two areas: (a) the psychology of language learning and (b) the process of deep learning. It will introduce a four-level learning model that provides a way to conceptualize the deep learning process. Implications for pedagogy are discussed.

The main message of this work is that an understanding of cognitive function encourages a 'hard science + soft heart' approach to foreign language pedagogy. A neurocognitive perspective stays grounded in an empirical understanding of mind—hard science—yet also encourages a holistic, humanistic, and ultimately transformative view of learning and the learner.

3. What is deep learning?

In everyday speech, referring to an experience as deep can mean different things. Often, it refers to something that engages our feelings (deeply felt) or is highly meaningful or elaborated (deep thoughts). Similarly, an idea or experience that is deep is thought to change us—to influence our thoughts, feelings or experiences in fundamental ways. A statement may touch us deeply and meeting someone can leave a deep impression on us. By contrast, experiences that are described as shallow or superficial are more obvious, routine and superfluous. A superficial conversation leaves little trace on us, and is soon forgotten. In general terms, then, the notion of learning which is deep implies a more fully engaging experience that changes us at a more foundational level of the self.

In educational psychology, the term deep processing has been used to refer to memory recall related to more elaborate analytic processes, as opposed to surface processing, which is related to a word's appearance or sound (Craik & Tulving, 1975). More recently, the term deep learning has been used to refer to processing involving implicit patterns of knowledge. Computer scientists use the term deep learning to refer to pattern-recognition algorithms that allow computers to learn on their own (Jones, 2014), which has led to advances in speech and image recognition, and increasingly accurate translation software (Lewis-Kraus, 2016). Deep learning can also refer to a more contextualized, reflective and abstract understanding, as opposed to a more superficial focus on information and facts (Halbert & Kaser, 2006; Rhem, 1995).

Both in artificial intelligence and in education, then, deep learning involves patterns of meaning—such as the recognition of an object, or a writer's point of view—that is not explicitly stated or defined, and thus must be inferred indirectly. This article will use this distinction between explicit (more concrete and directly perceivable) vs. implicit (more abstract and indirectly perceivable) meaning as a starting point for articulating a view of surface and deep learning. As we will see, surface learning will be conceived of as the processes involved with acquiring more explicit forms of (primarily conscious) knowledge, while deep learning involves the integration of complex patterns of (primarily unconscious) knowledge into the intuitive mind.

4. Deep learning and the intuitive mind

Surface and deep learning correspond to contrasting types of cognitive processing. We know this because of recent advances in our understanding of the neurocognitive processes of the mind (Hassin et al., 2007). Research in cognitive neuroscience has led to a "dual process" understanding of cognition (Evans & Frankish, 2009; Sherman, Gawronski, & Trope, 2014). This refers to the distinction between: (a) more conscious mental processes involved with focused attention, explicit knowledge, critical analysis, and conscious imagining and (b) unconscious processes that are more pattern-based, embodied and intuitive.

More conscious processes are engaged when we hold a thought in our head, "think through" a problem, imagine alternative outcomes, or analyze something conceptually. In everyday life, these processes are often referred to simply as thinking, or conscious thought, or more specifically as analyzing, imagining, focusing on, or paying attention to. Shaules (2014) refers to this as the *attentive mind*, terminology that emphasizes intentionality and focused attention. Our capacity for these forms of cognition is limited, however. This is why taking a test can be exhausting, and why we can focus on a difficult task only for so long. The attentive mind is also associated with executive function, the willful self-control we exercise consciously.

Deeper, less conscious forms of cognition are responsible for abilities that are complex, yet feel simple to us, such as vision, recognizing faces, processing language, habitual behaviors, or reading social cues (Mlodinow, 2012; Wilson, 2002). This constellation of cognitive function is referred to as: the adaptive unconscious (Wilson, 2002), the cognitive unconscious (Kihlstrom, 1987), the intuitive mind (Evans, 2010), the new unconscious (Hassin et al., 2007), the X-system (Lieberman, 2007), or fast thinking (Kahneman, 2011). The unifying feature of these conceptualizations is the idea that unconscious cognition is more powerful, more complex, and less under our control, than previously imagined. Wilson compares the intuitive mind to the auto-pilot of a modern jetliner, one that is able to fly without the input of the "conscious" pilot. Our attentive mind thinks it's in control, while in fact it's more accurate to say that "we (conscious beings) make up stories to maintain the illusion that we are the chief executive that is really in control" (Evans, 2010, p.6).

This article will borrow from Evans (2010), who refers to this deeper processing as the *intuitive mind*. The intuitive mind helps us manage the routines of everyday life—without us noticing it do so. It models our physical environment, shapes our interpretations of the world, draws our attention to important elements of our experience, and filters out unimportant information. It shapes our behavior in subtle but powerful ways, through our sense of what we want, what things mean, what feels right, how things work, or what is normal (Vedantam, 2010). The intuitive mind is not foolproof. It has a tendency towards bias: jumping to conclusions; self-justification; and a suspicion of difference (Banaji & Greenwald, 2013). The intuitive mind is also of crucial importance in motivation—we feel driven to do certain things and to avoid others (Campese et al., 2016; Salamone & Correa, 2012).

Unconscious cognition provides us with intuitive knowledge—the sensation of knowing without being able to explain how we know. We simply "know" when a sentence in our native language is grammatical; we somehow "read" the faces of friends and intuit their state of mind; we have a "feel" for how much salt to add to our scrambled eggs; we have a "sense" for how to be polite when disagreeing with someone. These intuitions may be relatively "built in" as in our ability to recognizing faces. But intuitive knowledge can also be developed through mastering a particular domain. These expert

intuitions guide our behavior for the skilled tasks we perform regularly, everything from driving a car, to playing sports, to performing surgery. They also develop in relation to abstract bodies of knowledge and abilities. Mathematicians speak of the "beauty" of mathematics, just as engineers may find an "elegant" solution to a building challenge.

Both conscious and unconscious cognitive processes are embodied. This refers to the idea that mental experience—including conscious thought, feelings and intuitions—are influenced by and inseparable from the body. It may feel as though our mind inhabits a purely mental space, but research suggests that this is an illusion. Our mental processes are rooted in, and inseparable from, the biological processes of the whole organism. The traditionally Western idea that thought and reason are fundamentally separate from body and feeling is giving way to a more integrated view of mind, feeling and body (Damasio, 2010).

A deeper understanding of cognitive processes and the intuitive mind sheds light on a foundational truth of language learning. Mastering a foreign language is not only, and perhaps not even primarily, an intellectual task. The focused attention and analytic processes of conscious cognition are rooted deeply in the functioning of our whole body. Language learning also requires the development of a complex body of intuitive knowledge—a "feel" for a how a language works and is used in practice. The development of intuitive understanding does not happen through memorization and pattern repetition alone—it requires learning processes that operate separately from conscious analysis and understanding. This learning process is deeply felt and transforms our intuitive experience of learning and language.

5. Linguistic knowledge is embodied and intuitive

Unconscious processing and intuitive knowledge are, of course, touched upon in foreign language education. The term "native intuition" typically refers to an L1 speakers intuitive understanding of grammaticality and language use (Abrahamsson, 2012). In addition to grammatical intuitions about language use, intuitive knowledge in social interaction is recognized by social psychologists, who refer to it broadly as social cognition (Moskowitz, 2005), schema (shared frameworks, associations and background knowledge) and scripts (interactive routines of daily life). Language use is also recognized to involve an intuitive understanding of cultural nuance, social expectations and worldview (Byram, Nichols, & Stevens, 2001; Kramsch, 2015). From the perspective of the intuitive mind, linguistic knowledge and socio-cultural knowledge are closely related, since our intuitive sense for linguistic meaning is rooted in our cultural worldview (Fantini, 1991; Luna, Ringberg, & Peracchio, 2008).

Our understanding of intuitive linguistic knowledge is also increasingly being informed by embodied simulation theory, a neurolinguistic approach to understanding how the mind produces and processes linguistic meaning (Bergen, 2012). According to embodied simulation theory, linguistic meaning does not consist primarily of symbols that act as labels for thoughts. Instead, language use entails a mental simulation in the sensory and motor cortices based on our previous experience. This simulation is embodied—it engages the cognitive processes associated with emotions, behaviors and experiences. Even abstract knowledge may be experienced metaphorically as related to the physical world, as when we *look forward* to the future, or are *fed up* with someone's attitude. Language processing uses the same cognitive resources as experiencing the physical world, which is why it's difficult to pay attention to one's surroundings while talking on the phone.

6. Deep learning in Second Language Acquisition(SLA)

The distinction between conscious and unconscious cognitive processes is recognized within the field of SLA, which distinguishes between explicit learning—that which involves focused attention and conscious effort and analysis—and implicit learning that happens out of conscious awareness (Budzowski, 2009; Ellis et al., 2009). In a review of the paradigm of implicit and explicit learning, Dornyei (2009) points out the concepts of explicit and implicit learning overlap and compete with a number of conceptualizations, such as: explicit/implicit knowledge, explicit/implicit memory, incidental versus intentional learning, as well as declarative and procedural knowledge. These terms are related, in turn, to concepts such as consciousness, the noticing hypothesis, automatization, and skill learning theory. Declarative knowledge has been called "-knowledge that takes the form of a factual or declarative statement" (Winne & Azevedo, 2014, p.65), as when someone says "Adjectives are words that modify nouns." Procedural knowledge is "knowledge of processes and actions for addressing a task, often called know-how" (pg. 65). The work of Stephen Krashen (1982) has argued for a distinction between language learning (a conscious process of focused attention and analysis) and acquisition (implicit learning). In addition, vocabulary acquisition is often talked about in terms of breadth (the number of words) and depth (knowledge of many aspects of a word) (Hatami & Tavakoli, 2012). Language teachers also commonly distinguish between accuracy practice—focusing on a conscious understanding of linguistic patterns—and fluency practice, which focuses on using language spontaneously.

There is no consensus on the precise relationship between explicit instruction and implicit learning (Budzowski, 2009; Ellis et al., 2009; Suzuki & DeKeyser, 2017). Research involving artificial grammars has shown that through trial and error it's possible to learn grammatical patterns intuitively without receiving any explicit instruction (Reber, 1967; Rebuschat & Williams, 2012). Research has also shown that instruction that focuses learner attention explicitly on elements to be learned is more effective than instruction in which learning is incidental and implicit (Norris & Ortega, 2000). Other research focuses on how to measure implicit and explicit knowledge (Ellis, 2009) and how implicit and explicit knowledge contribute to language proficiency (Budzowski, 2009).

An understanding of deep learning must be informed by research into implicit and explicit learning. The deep learning perspective contrasts with such research, however, in its focus on a holistic and embodied view of the learner, and its concern for the psychology of learning. Research into explicit and implicit learning is heavily influence by a cognitive perspective, one that sees language learning in terms of the acquisition of grammatical forms. The deep learning perspective reminds us, however, that unconscious cognition does much more than recognize grammaticality—it is central to our everyday functioning in the world, and thus to our sense of self. The deep learning perspective seeks to discourage a reductionist view of the learner as a set of disembodied cognitive processes. It sees language learning in the context of our intuitive experience of the world, and the psychological challenges of making adjustments to these foundational elements of self.

7. Towards a definition of deep learning

Based on our emerging understanding of cognitive processes, deep learning can be seen as the process of integrating/constructing a complex body of linguistic knowledge into the cognitive architecture of the mind. Deep learning is contrasted with surface learning, which involves conscious thought and focused attention on explicit elements of learning. This

conceptualization is concordant with a complex systems understanding of second language acquisition (Larsen-Freeman, 2011). In this view, language is "a complex adaptive system, which emerges bottom up" (p.49) from interaction, rather than as a static system regulated by fixed rules. As Larsen-Freeman points out, this implies that "language learning is not just about adding knowledge to an unchanging system. It is about changing the system" (p.57). Patterns that were stable within the learner must become unstable, and new systems must emerge in a new and stable form.

Automaticity is important to deep learning. But simply getting information into long-term memory doesn't guarantee the development of increasingly complex cognitive structures or richer intuitive knowledge. Memorizing vocabulary items, for example, doesn't guarantee the ability to communicate spontaneous. Deep learning relies on a range of unconscious learning processes—pattern recognition, trial and error experimentation, and habit formation. Foreign language learning overall relies on a wide range of cognitive capacities—both conscious and unconscious—which contribute to the emergence of increasing levels of cognitive complexity, and the development of intuitive understanding and sense of mastery.

8. The psychology of deep learning

The deep learning perspective reminds us that language learning is a deeply psychological endeavor. It involves integration of foreign patterns deep into our psyche—as we learn a new language we are restructuring the cognitive architecture of the mind. That's why learning outcomes depend so heavily on the motivation, aptitudes, personality, experiences and attitudes of each individual learner (Dornyei, 2009). We also see this also in the study of motivation—particularly as it relates to self-concept and social identity (Csizer & Magid, 2014; Dornyei & Ushioda, 2009). Understanding language learning requires a focus on each learner as a unique individual, with his or her own life experience, abilities, goals and psychological profile.

Language learning is psychological in another important sense—it challenges us at deep levels of self. Learners must not only learn to use a new linguistic code, they must reinvent themselves as a speaker of a foreign language. This requires a stressful period of limited understanding, awkward interaction, minimal ability to express oneself, and difficulty relating to others. True, some exceptional learners may enjoy language study as a sort of mental challenge or linguistic puzzle. Even for gifted learners, however, learning a new foreign language beyond childhood is a tremendous challenge. And while more academic subjects—physics, engineering, law—are intellectually challenging, they don't require modifying how we express ourselves and interact with others, and are thus less central to our sense of self. Language learning can be stressful to the point of trauma. It can also be a life-affirming experience—one that provides us with new ways of communicating, thinking and acting, and sometimes even a transformed sense of self.

The psychological demands and transformative potential of language learning receive relatively little attention in the professional literature. The study of affect in language learning, for example, primarily focuses on modeling how affect influences learning outcomes (Schumann, 1997). There is little emphasis on the thoughts, feelings and personal reactions that make language learning psychologically challenging. As Dornyei (2009) points out:

> Everybody knows that classrooms are venues for a great deal of emotional turmoil, yet affect has been an almost completely neglected topic in educational psychology. Everybody knows that the study of a second language can

> be an emotionally taxing experience, yet affect has been an almost completely neglected topic in applied linguistics. And finally, everybody knows that emotions are frequent sources of action—for example, when we act out of fear or anger or happiness—and yet affect has been an almost completely neglected topic in motivation research (p.219).

There are exceptions. Stevick (1976, 1980) emphasizes the psychological stresses of language learning, speaking of learners who find that "information is being imposed on us from outside ourselves. . . . We find ourselves in position of being ignorant, powerless, and constantly evaluated—a clear denial of our primacy" (Stevick, 1980, pp.9–10). Such an experience, he reminds us, can be traumatic. Similarly, some teaching methodologies, such as Suggestopedia or Community Language Learning, emphasize the creation of non-threatening and more deeply meaningful learning environments (Curran, 1972; Lozanov, 2005). Tochon (2014) has outlined what he calls a *deep approach* to language learning—one that focuses on student-directed projects that integrate language and culture thematically and holistically.

Some scholarship treats the psychological challenges of language learning in terms that imply learner dysfunction. Negative terminology includes learner anxiety (Horwitz, Horwitz, & Cope, 1986; Trang, Baldauf, & Moni, 2013) demotivation (Kikuchi, 2013; Sugino, 2010) or (a lack of) willingness to communicate (Yashima, 2002). Such terminology implies pathology, as though learners who feel anxious or hesitant are somehow defective. This overlooks a broader truth—that language learning requires a great deal of psychological change and adjustment, and includes positive transformational potential.

9. Complex skills and intuitive knowledge

From the deep learning perspective, the implicit acquisition of linguistic patterns can be seen as part of a larger cognitive phenomenon—our ability to internalize and master complex bodies of knowledge more generally. Complex skills are those that rely on a constellation of simpler elements that combine to form a higher-order ability. Cooking, for example, requires knowledge of ingredients, the physical abilities of cutting, frying, baking, and an understanding of how cooking processes affect ingredients. This knowledge comes together to form a complex skill that we refer to as cooking. Mastering a musical instrument, learning to play tennis, and becoming fluent in a foreign language—all involve the internalization of complex bodies of knowledge made up of multiple sub-skills or abilities.

Acquiring complex skills results in the development of *intuitive knowledge*—the "feel" for a domain based on experience. A skilled tennis player has a *feel* for the game and a style of play particular to that person. A good cook has a sense for how to combine ingredients in creative ways, and develops their own style in the kitchen. Intuitive knowledge leads to a feeling of mastery and flow—the ability to lose oneself in, and express oneself through, that particular domain—no two people cook, play music, or speak a language in precisely the same way. At the same time, intuitive knowledge is often hard to articulate. A musician may master an instrument without being able to explain music theory. In language learning, intuitive knowledge involves verbal fluency, comprehension of overall meaning, an understanding of gist, the ability to "think in the language", the ability to read for pleasure, spontaneity, and the creative use of language.

10. The attentive mind and the critical self

Acquiring complex skills typically involves both the attentive and intuitive mind. The internal monologue of the attentive mind is often experienced as a critical self—a master planner that thinks strategically, makes plans, and keeps our attention focused on important tasks. Unfortunately, the critical self is not always a good guide for learning. The strategies that work well for conscious learning, such as "trying hard" may backfire for more intuitive practice. The critical self and performing self can be in conflict, as when a tennis player berates himself with thoughts such as *That was a terrible shot! Keep your eye on the ball, you idiot!* (Gallwey, 1974) Such self-criticism is not uncommon among language learners and can produce feelings of inadequacy. Learners who proclaim *I'm terrible at language learning* may be expressing frustration rooted in a conflicted relationship between differing forms of cognition.

Learners need a clear conceptual understanding of how deeper learning happens, so that their attentive mind can most effectively oversee that process. Absent that, the critical self tends to fall back on truisms such as *I need to study more* or may feel helpless or unmotivated, because it can't easily chart a course for learning. With that need in mind, the next section will look in more detail at how complex skills are acquired, with an eye to providing the attentive mind with a way to conceptualize deep learning.

11. Complex skills and dynamic skill theory

To understand in more detail how complex skills are developed, we can borrow insights from *dynamic skill theory* (DST) an approach to understanding cognitive development elaborated by Kurt Fischer (Fischer, 2008; Rose & Fischer, 2009). DST is a neo-Piagean approach to understanding how simple skills are combined into higher-order skills. DST was originally developed to understand the developmental learning processes of children, but also sheds light on the development of complex skills in general. Consistent with this, it has recently begun to be used to inform foreign language education (Murphy, 2015; Murphy & McClelland, 2011; Shaules, 2016). The foundational insight of DST is that complex skills are not developed gradually through an incremental, linear process. Learning a foreign language is not simply a process of gradually adding new bits of knowledge until mastery is achieved. Instead, new skills are developed at different levels of organizational complexity—simple skills build on each other, with each new level representing a shift into a new state.

DST describes four of these levels using the terms: (a) single set; (b) mapping; (c) system; (d) systems of systems. Complex skills first start to be developed as a collection of *single sets*—discrete knowledge or individual skills learned separately. These skills then must be connected in a process of *mapping*, in which meaningful connections are made between individual elements. When those connections reach a critical level of interconnectivity, they start to function together holistically, as a *system*. That system no longer operates as a set of sub-skills, but as a higher order skill. That systematic knowledge, in turn, can be connected to other systems of knowledge at a *system-of-systems* level of organizational complexity. As seen in Shaules (2016, p.6), This progression can be represented visually as in Figure 1.

Learning a foreign language—as opposed to acquiring it naturalistically in childhood—typically begins with the learning of discrete knowledge/skills: individual vocabulary items, grammatical rules, or new sounds. This corresponds to the single set stage of learning. Simply remembering lists of words, however, does not lead by itself to communication or mastery. These different items must next be connected to each other in meaningful ways. Using vocabulary items to form sentences, for example,

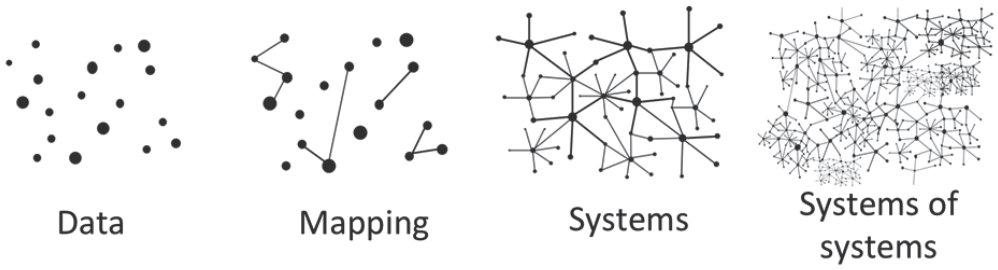

Figure 1. Levels of dynamic skill theory

creates connections between previously discrete elements of knowledge. This corresponds to the "mapping" stage in DST. Learning individual vocabulary words involves a different level of learning than making sentences—they exist at different levels of cognitive complexity. You need the first to accomplish the second, but accomplishing the first doesn't automatically lead to the second. Learning must go through a phase shift, in which a higher order skill emerges from the components that preceded it.

Even after having acquired a great deal of discrete knowledge, cognitive mapping is a long and involved process. It may involve increasing mastery of chunks of knowledge in isolation—students may learn to make perfect sentences as part of a written exercise, yet not be able to apply that knowledge in the hallway after class. Mapping is made easier if there is a strong foundation of single sets to work with. On the other hand, focusing too much on acquiring single sets, without an opportunity to map that knowledge into larger networks, may make applying that knowledge more difficult. Students who spend all their time studying list of vocabulary items, but who hesitate a lot when trying to speak, may be getting stuck in this way.

The third level of DST—systems—represents an exponentially higher level of organizational complexity. Once the mapping process reaches a certain critical mass, the mapped elements coalesce into a working system of knowledge. This systematic knowledge operates holistically, rather than as a collection of sub-skills. For language learners, this entails a quantum leap in language experience and use. It may involve using the language "without thinking", rather than consciously constructing sentences in one's head. At these moments, the language starts to be experienced as something greater than the sum total of its parts. It is experienced as a functioning whole that becomes an increasingly natural part of the self. The notion of "fluency" captures the subjective experience of this level of learning—as opposed to the laborious process of consciously constructing utterances.

Once a domain starts to be mastered at the systems level, that knowledge can be connected to other domains in a systematic way as well—as a system-of-systems. Such knowledge exists at a higher level of abstraction and experience still. For example, a learner may master a foreign language (a specific domain), but then become curious about language learning more generally. This may lead to the study of linguistics, education, and other domains that eventually may coalesce into a higher-order understanding of language learning principles. It is at the system-of-system level that a language learner gains the more sophisticated understanding needed to be a good language teacher, or that a tennis player goes beyond simply playing the game herself, and learns to become a coach to others. This is an exponentially more complex level of knowledge, which is why master practitioners can never learn everything—there are always more domains of knowledge to integrate into their understanding.

It's important to note that these levels of learning

are not exclusive to each other. It's not the case that we reach one level of learning and never go back. These are not stages that we pass through. Rather, they are levels of complexity that we use when carrying out a task. Even experts process a foreign language at multiple levels, and move back and forth among them. For example, someone who must translate an article may at different times: read over the article for general meaning (systems); look up particular words in a dictionary (single set); labor over the best way to structure a particular sentence (mapping); and think abstractly about the best approach to take for this translation (system-of-systems).

12. Transformative learning

The deep learning perspective encourages a transformational view of learning. That doesn't mean we become a new person. Rather, as we gain intuitive knowledge, there is an evolution in our experience of the new domain—it becomes more differentiated. Differentiation refers to the perceptual categories we use to make sense of our experiences (Bennett, 1993). Put simply, less familiar domains are experienced or perceived more simply. This idea has been elaborated by Bennett, who points out that people with little intercultural experience have simple perceptual categories for making sense of cultural difference. This leads to simplistic or stereotypical notions, as when someone perceives anyone who speaks another language simply as a "foreigner".

Similarly, monolingual people typically have simplistic notions about foreign language learning. Inexperienced learners may say that their goal is to "speak like a native" without understanding how difficult that is. They may assume that fluency comes from knowing lots of words and being able to say them quickly. Such naïve learners don't simply lack knowledge or facts. Rather, their intuitive understanding of the learning process has only limited experience to draw on. Sometimes, they may have studied a language for years, but only through textbook learning and memorization. For such a learner, this *is* language learning. More advanced learners, on the other hand, have a more nuanced view of the learning process. Someone who learns a foreign language, and then goes on to learn another one, has an advantage over less experienced learners. They have an intuitive sense for how language learning works, even if they've never studied second language acquisition.

To make sense of this developmental process, Shaules (2016, p.8) argues that the four levels of DST correspond to four ways of experiencing foreign language learning—*encountering*, *experimenting*, *integrating* and *expanding*. These terms describe the subjective experience of learning at different levels of cognitive complexity. Learners first encounter a foreign language as a set of facts and discrete items to practice. They may assume that they key to foreign language study rests in how many of those items they know. As learners do more mapping, they experience language learning more in terms of experimenting with the language, as they form sentences or practice language forms. If they manage to integrate these forms more fully, they start to experience the foreign language as a creative part of the self. At the systems-of-systems level of understanding, they have an expanded awareness of themselves as language learners and users.

Shaules points out that increasing levels of cognitive complexity correspond with a more integrated experience of the new language. At the encountering stage, a new language is commonly experienced as alien and external to the self. At higher levels of processing, it ceases to be so foreign and starts to feel integral to the self. Beginners may describe what they are doing as studying or learning, while intermediate learners might say that they are practicing the language. More advanced learners may feel they are simply using the language. Learners' cognitive

complexity also influences how learners approach the learning process: naïve learners will use naïve learning strategies. They may conceive of language practice, for example, only in terms of memorizing more vocabulary words. Educators should help students see language learning as an evolving experience of using language, rather than a bunch of words to know, or a collection of phrases to use in a given situation.

An understanding of these levels of learning can inform pedagogy. Activities that provide scaffolding from one level of processing to another can help learners break through to a higher level of language use and experience. A speaking activity that provides support at the encountering and experimenting level may help students experience the integration level of language use. Once they get a taste for this less conscious, more fluent, more spontaneous use of language, they can better attempt to recreate this mental state in the future. By drawing learner's attention to their subjective experience of language use, we are putting them more in control of their own learning.

13. Implications for pedagogy

An understanding of cognitive processes does not, by itself, tell us how to teach. It does, however, provide us with some guiding principles that can orient us towards deeper learning. The following sections are intended as a starting point for considering the implications of the deep learning perspective. A fuller reflection is beyond the scope of this article.

13.1 Focus on the whole learner

Language learning is an embodied process that touches us at many levels of the self. Pedagogy which treats language learning primarily in terms of conscious knowledge is more likely to get stuck at simpler levels of cognitive processing. Deeper learning requires a higher level of personal commitment and motivation than would be required for more purely conceptual understanding. Teaching a foreign language as a primarily intellectual task may work for more limited learning goals, such as scoring well on a test. Educators who want to accomplish more than this, however, need to focus on the feelings, needs, frustrations, aptitudes, motivations, and personalities of individual learners. Successful language teachers are not only experts, they are also coaches and counselors.

13.2 Encourage learning awareness

Learners need to understand that there are two forms of knowledge: (a) conscious knowledge (attentive mind) and (b) intuitive knowledge (intuitive mind). Learning awareness activities can help focus students attention on the learning process, and turn language learning into a more personalized, psychologically rewarding experience. This can involve feedback activities, personal goal setting, self-monitoring and so on. If they can become aware of moments when they reach higher levels of processing, they can strive to reproduce the conditions that created them and better chart a path forward in their own learning.

13.3 Rethink motivation

Motivation is rooted in the intuitive mind—we cannot easily choose what motivates us. From the perspective of the neurocognitive structures of the brain, there are two kind of motivation: approach motivation (that which takes us towards a desired outcome) and avoidance motivation (that which moves us away from an undesired outcome). This is an area that is only beginning to be explored in language education (Lucariello et al., 2016; Shaules, 2017). From the deep learning perspective, motivation in language learning can be seen as involving a process of psychological adjustment that results from needing to internalize foreign patterns into the unconscious mind.

13.4 Encourage trial and error

Many learners seek learning that leads to the certainty of a correct answer. Deep learning, however, requires a pattern-seeking and trial and error orientation to learning, one that includes guessing, making connections on one's own, and experimentation. Such learning requires a degree of tolerance for ambiguity, and an acceptance that things won't always make sense, be easily explainable, or perfectly translatable. Classrooms that embrace the ambiguity and complexity of deep learning are more likely to achieve it.

13.5 Try to achieve flow

Deep learning is encouraged by getting students into a flow state—the feeling of losing oneself in an activity that is challenging and absorbing (Csikszentmihalyi & Rathunde, 1993; Egbert, 2003). Flow requires that a task is difficult enough to require full attention, but easy enough to become absorbed in. Flow represents a balance between attentive and intuitive learning processes—our conscious and unconscious mind work together to accomplish the task at hand.

13.6 A holistic view of the learner

The most fundamental implication of a deep learning perspective is the importance of a holistic view of the learner. Recognizing the experiential, experimental and psychological nature of language learning reminds us that pedagogy must engage learners at many levels of the self. Much traditional language education, however, focuses on surface forms of the language and treats learning as primarily an intellectual or academic exercise. Such an approach is short sighted, as it emphasizes the immediate goal of acquiring and measuring linguistic knowledge, while ignoring the deeper challenges and transformative potential of language learning. This tendency is deeply engrained in the educational system in Japan. Changing such a deep-rooted phenomena will not be easy, but without moving in this direction, it's hard to see how significant improvement can be made.

14. Conclusion

Research into unconscious cognition is challenging language educators to rethink the mental models used for conceptualizing learning processes. It also challenges educators to more fully take into account the highly psychological nature of language learning. This article has touched only on some issues raised by our increasing understanding of cognition and mind. It seeks to be a starting point for reflection and praxis. The ultimate goal is pedagogy better grounded in a clear understanding of cognition, mind, and learning. It also seeks to encourage a deeper, more holistic, more humanistic approach to language learning—one that provides an opportunity not only for increased linguistic ability, but also personal satisfaction and growth.

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