NEW VOICES

Learning from learners

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I immerse myself in three disciplines: research, music and art. I am a Postdoctoral Fellow at the University of Rochester, after receiving my PhD in cognitive development from Birkbeck, University of London in 2011. I was also a violinist in a rock band (The Outside Royalty), and completed a degree in fine art and design at The Institute, Middlesex University in 2011. My passion for mastering methods and techniques in different fields serves as a personal case study for cognitive development research. Studying the learning strategies of infants, arguably the best learners, not only helps us understand them, but also provides insights into lifelong learning.

How do infants learn?

Since the 1950s, cognitive development research continues to uncover learning strategies employed by infants. In the first year of life, infants learn an amazing amount of information – for example, what objects are, why objects disappear and reappear, what words mean, and how to move around in their environment. Infants are capable of much more than we originally thought. Besides having to learn many things in a short amount of time, infants also have a unique problem of figuring out what to learn. Infants exist in a world that is very busy – it is constantly full of many things to learn about, as well as many distractions that are not worth learning. How do infants figure out what to learn with such speed and accuracy?

Two important findings from developmental psychology research are that infants learn to work with experts (adults) to figure out what to learn and that they learn many skills simultaneously. My collaborators and I have found a number of factors (cues) that focus infants on what to learn by directing their attention to appropriate events. One very important cue is people. When infants do not know what to learn, people can direct infants' attention to particular things in the world and help them learn appropriate information. While the fact that people do this is not a new discovery, we (and others asking similar questions) are investigating how infants learn from people in the first year of life.

Working with infants younger than 12 months of age is tricky because they cannot tell us what and how they learn. Therefore, we have to use indirect measures, such as observing where they look, their manual behaviours, and how their brain responds. The first step in our line of work compared how infants learn with different cues and found that by eight months of age, infants learn better from people than on their own or from other cues that may direct their attention, such as a bright flashing light (Wu et al., 2011; Wu & Kirkham, 2010). In these studies, we showed infants two objects on a computer screen, with a face turning to one object, flashing lights over an object, or no cue over either object. While both the face and flashing lights helped infants pick out an object to learn by directing their attention to it (when no cue was present, infants did not choose an object), only the face helped infants learn about the object. Our ongoing work investigates how infants start learning from people.

Another interesting area of research emerging in infant development is how the acquisition of one skill correlates or even helps with learning another. This can happen within one domain (e.g. vision), or across domains (e.g. motor and vision). In one study, Quinn and Bhatt (2009) found that young infants could use one way of grouping visual features together to learn a new way of grouping them. Another study by Soska et al. (2010) showed that infants who could support themselves while sitting on their own were better at understanding the 3-D nature of objects, presumably because these self-sitting infants had more and different types of experience manually exploring objects compared to their non-sitting peers.

Besides learning from experts and learning many skills simultaneously, a constraint that infants have to deal with is the lack of an extensive backlog of previous experience that adults can rely on when learning. But in return, infants are more flexible than adults in learning new skills because they cannot impose previously learned structure onto incoming information. For example, when infants learn a language, they first seem to identify key building blocks of that language (e.g. words, sounds). They cannot, like adults, map foreign words and grammatical structure onto known equivalents in a familiar language (e.g., book = *libro* in Spanish) because infants do not have a 'familiar' language. Another critical aspect is that infants learn to master everyday survival skills (e.g. walking, language), while adults often learn to acquire skills that are not essential (e.g. a hobby). Perhaps the total commitment that infants display when learning is the difference between fully mastering versus simply acquiring a skill. Finally, infants are extreme explorers; they possess qualities that are often lost

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by adulthood: curiosity, novelty seeking, always learning (and adapting) without much hesitation, and perhaps most importantly, not being afraid of failing. These critical characteristics of infant learning work together with powerful learning mechanisms (e.g. learning patterns and structure) to produce the best learner. While we still possess the same learning mechanisms as adults, we often lose the youthful characteristics of learning in adulthood.

'The Dilemma of the Naïve Learner' (2011)

Application of infant learning during adulthood

How adults learn to master new methods and techniques in multiple fields has two main similarities to how infants learn: cross-pollination to draw novel links, and maintaining an informed explorative state by building multiple lines of expertise while preserving the sense of being a learner. Both of these effects are incredibly beneficial not only for the infant (as described above), but also for the adult learner.

Mastering creative skills for art in adulthood is similar to how infants have to learn. In learning how to create traditional forms of art, one of the key skills is knowing what to look for, which is difficult to teach explicitly and is achieved via full immersion. From my observations, full immersion without imposing too much previously learned structure on new information (similar to the infant strategy) seems to be an important factor influencing whether adult art students excel. The students who just 'went with it' did well, while the students who struggled were those who thought too much about what they were doing. The instructors on my art course also encouraged me to take multiple classes simultaneously using different techniques (e.g. sculpting, painting, drawing) to achieve a bandwagon effect and improve my artistic skills exponentially. Compounding the course load increased my commitment to art, while allowing me to transfer skills from one area to another (e.g. tonal drawing to value contrasts in painting, sculptural form to planes in drawing).

One way to foster links between fields is to stretch beyond traditional boundaries. In the scientific domain, the workshops that my collaborators and I have organised have drawn links among key findings in developmental psychology, atypical development, computational modeling, and cognitive neuroscience. Actively seeking commissions also encourages the simultaneous exploration of artistic and scientific processes. For example, co-designing the bronze medallion for the David E. Rumelhart Prize (rumelhartprize.org), a $100,000 award often referred to as the 'Nobel Prize' for cognitive science, required summarising all of cognitive science in one simple line drawing. Challenges like this result from having different constraints and expressing research findings in new media, such as my painting above.

Another important aspect of infant learning is maintaining an explorative state. The benefits of learning like a beginner are noteworthy and apply equally well to scientific inquiry (e.g. Simon, 1991). It is often the case that the most important research requires digging more into the unknown, asking scientists to be what Schwartz (2008) refers to as 'productively stupid'. At the very least, always learning and feeling stupid is a humbling experience that keeps our egos in check (something that some of the academics, musicians and artists that I have met could benefit from). Perhaps a productively stupid state is easier to maintain for specific careers (e.g. academia) and during more naive younger ages, when we have more time and less societal pressure to produce. Consider Herb Simon, who is often referred to as a Renaissance man. He is one of the most influential scientists in the past century, with expertise in at least nine fields including economics, for which he received a Nobel Prize. Related to the earlier point about linking fields, Simon (1991) suggests that exploring and changing fields every decade allows us to build up 'secret weapons' of innovation, such as using a known tool in a novel way (e.g. Galileo using the telescope to perfect the microscope).

A way forward

In understanding the task that infants face, developmental research provides a unique perspective on the learning process (Gopnik, 2009). While cognitive development research allows us to understand typical infants and help those with learning difficulties, adults also can adapt some of these infant strategies to enhance our ability to learn things we think we cannot. There is even evidence that continued learning, even in adulthood, helps us retain the potential to learn in the future (see Herholz & Zatorre, 2012 for a review on musical training, which requires the interaction of several skills). This raises the prospect of sustaining the drive to learn and other youthful behaviours well into adulthood.

Learning in adulthood, however, seems to be a luxury given increasing pressure not to fail by producing successful products. Academia, especially, requires researchers to be experts in specific areas usually in one field, a sort of anti-Renaissance (wo)man. This leads to the question of what we lose as adults if we are constantly learning. Would we forget previously learned information because it is replaced with newly learned material? Would we not learn anything in too much depth because our time is spent in too many areas? With such potential pitfalls, the learner has to find a critical balance between exploring and exploiting what is in the environment – the dilemma of the learner (for an interesting account of this balance, see Ferriss, 2012). On one hand, learners should not lose focus, but on the other hand, they should not have tunnel vision. The aim of my future research program is to understand different learning strategies for negotiating this balance and how they impact the learner at different stages of development. Stay tuned.

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