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COMMENTARIES

The Human Unconscious in Evolution

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The thoughtful article by Vaughn Becker and Steven Neuberg (this issue) on Carl Jung's concepts of a collective unconscious, and of archetypes, is a worthwhile proposal with its basis in evolutionary theory. The idea is of states of mind that can be on the edge of consciousness, shared by people across the world, which come to us in several ways, such as dreams and pressing thoughts based in emotions that we do not always understand.

In this commentary, may I propose that recent movements in cognitive science can help carry this idea forward? Three such developments are the instantiation of machine learning in artificial intelligence, evidence and theories of how emotions work, and research on the evolved human capacity for cooperation.

Deep Learning

Becker and Neuberg (this issue) helpfully introduce the idea of subsymbolic systems as bases for a collective unconscious and for archetypes. The cognitive revolution can be thought of as having started in the early 1950s (Gardner, 1985), based on theories of generative grammars and artificial intelligence. These approaches involved rules, logic, and handwritten computer programs. All these systems were symbolic. Becker and Neuberg point, helpfully, to an alternative: subsymbolic distributed neural networks (McClelland & Rumelhart, 1986). In the last 20 years, this approach has yielded new procedures that include deep machine learning. These developments have been promoted by Hinton (e.g., Hinton 2007; LeCun, Bengio & Hinton, 2015). They are reviewed and discussed by Lake, Ullman, Tenenbaum, and Gershman (2016) and Oatley (2018). They can be thought of as a second phase of the cognitive revolution. To add this second phase would be helpful for Becker and Neuberg's proposal.

Deep machine learning is based not on symbols, rules, or procedures such as "if this, then that" but on exposure of many examples to layered networks of artificial neurons that have thousands of connections with one another. It has been shown that such systems can, without supervision, form generalizations of patterns that recur in the examples. These become encoded into the strengths of the connections among the artificial neurons. After such learning, a system can be thought to have constructed what one might call inner intuitions, based on the its generalizations. This kind of system is now used for perceptual issues, which include tasks such as when one asks, on Google, for visual images of verbal ideas such as "house," "jewelry," or "illness"; for tasks in medical diagnosis that involve discriminations among images, for instance, from X-rays and MRI scans; and for many tasks in industry.

This kind of system is now also used for translation from one language to another. For this task, millions of word sequences in one language are input, for instance, from Wikipedia. Inner intuitions of the meanings of these sequences are constructed as distributed structures of interneuronal connections. Then, to translate, this learning-based system runs the intuitions in reverse into those of another language, such as French. This is the basis, for instance, of Google Translate. This learning-based system is now superior to rule-based systems based on phrases from one language that have been matched by human programmers, one by one, with those from another language. A nontechnical account of this subsymbolic work, including its instantiations by Google, may be found in Lewis-Kraus (2016).

This kind of procedure seems similar to the way in which children learn the language with which they grow up, as well as new languages. But the issue goes further. Not only can this kind of process happen during the life of an individual, but in a comparable way it is likely that, in the course of evolution, structures have been instantiated in the human genome. The result is that we grow up with certain genetically based proclivities. So we see the world as being made up of objects that we can pick up and places to which we can go. It also includes tendencies to recognize different kinds of people with whom we can relate, such as those who might nurture, those who might help, those who might threaten: archetypes.

Although cognitive language theory and early artificial intelligence were based on rules and logic, it now seems likely that such symbolic processes are not really generative. They might, instead, be better seen as post hoc summaries of language-based utterances and of actions. As Becker and Neuberg suggested, evolved subsymbolic systems can produce what I have here called *intuitions*. These may indeed be usefully characterized in terms of a Jungian collective unconscious.

Emotions

Becker and Neuberg (this issue) take up the idea of emotions and their relation to motivation. For the issue they

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discuss, this is likely to be a good way to proceed. It seems to me that, again, they might go a bit further.

As Simon (1967) pointed out, any intelligent being needs something like emotions because, to be intelligent, one must make mental models of the physical and social world. A problem is that such models can never be complete. Nor can they ever anticipate all the events that could be caused by other intelligent beings. Emotions are those mental processes that recognize events that are significant and unexpected and then urge us in a particular direction that is likely to help us deal with what has happened. Certain kinds of significant events, such as successes and failures, have recurred over millions of years. So, during evolution, it has been adaptive for them to be recognized, and accompanied by, promptings in directions that on average would be useful. Some of the reasons for such states, when we experience them in our modern selves, as Jung pointed out, is that such promptings (or urges) can occur for reasons that are unconscious.

The most widely accepted theories of emotions, now, are cognitive. Perhaps the best known is due to Frijda (1986, 2007). It is that emotions occur most often when some event, usually in the outer world and generally to do with another person or group, affects an inner concern. Frijda's theory of emotions is based on what he calls *states of action readiness* (see also his discussion of ur-emotions; Frijda & Parrott, 2011).

Becker and Neuberg helpfully introduce the research of Panksepp (a recent update being Panksepp & Biven, 2012). This research traces the origins of distinct emotions through many animal species into particular human brain structures that have evolved to deal with recurrent issues. The cognitive emotion-theory of Oatley and Johnson-Laird (1987, 2014) is based on evolution, in the kind of way proposed by Pankespp. One may think of it, also, as deriving from the kinds of considerations that were written about by Jung. Oatley and Johnson-Laird postulated nine fundamental emotions, each of which has been constructed in the kind of way I suggested in the previous section. These deal with situations that have occurred many times during primate and human evolution, and that still recur for each of us today. Each one can be thought of as consisting of a combination of a small group of those modes that Frijda called states of action readiness.

An example is happiness. It has what Becker and Neuberg rightly call a basis in motivation. It enables us, in terms of states of action readiness, (a) to continue with what we are doing, (b) to pay attention to certain people, (c) to offer to them affectionate words and gestures, and (d) engage with them in ways that are helpful and positive. An example occurs when a person we love arrives at an airport or off a train. We go to meet them, enacting and continuing the plan we have constructed to do that; we smile and give them a hug, and perhaps we carry their bag for them. Fear, the emotion of danger, is a kind of opposite. It prompts us, by means of small group of states of action readiness, (a) to stop what we are doing, (b) to freeze, (b) to make ready to avoid or escape, and/or (d) to make ready to resist. Another emotion—anger—is the emotion of conflict, in which we ready ourselves to attack another person, usually verbally, in an attempt to get even, because we see that other as not having fulfilled commitments in a relationship. Yet another emotion—sadness—is the emotion of loss, which usually prompts us to withdraw a bit from social situations, to reflect on what has happened, and sometimes to accept help. An up-to-date review of research on emotions can be found in Keltner, Oatley, and Jenkins (2019).

According to such conceptions, emotions are based in underlying structures, derived from many examples of recurrent events during our evolution. When we feel some of these emotions, we may not fully understand them; that is, they may be partly unconscious. We may find ourselves, then, wondering, "Why do I feel content at being with this person?" Or "I know that I am angry with that person, but I'm not going to see her or him again, so why do I let incidents I have experienced with her or him keep going around in my mind in a way that I can't seem to stop?" Or "I am sad with this loss, but why, since what is lost is no more, can't I just get on with other activities in my life?"

Cooperation

Although, following Jung, Becker and Neuberg (this issue) are progressive in making the collective unconscious social, may I suggest that they don't go quite far enough. Starting perhaps 200,000 years ago, human beings became not just social—in the way that chimpanzees can be—but cooperative. As Tomasello (2014, 2016) has suggested, this occurred in two movements.

The first of these movements Tomasello called "joint intention." Humans can make arrangements with others based on joint goals on which they agree, which they carry out as shared plans, to which they give priority over individual goals and plans. An attribute of this newly acquired ability is that we humans, but not apes, can see a person enacting a sequence of behavior and see it as a plan; this is a new kind of cognitive inference, based on knowing that we and others have agency in the world. Then we can see that, when something in that plan goes wrong, we can sometimes know how to generate another piece of behavior to help that person complete the plan successfully (see, e.g., Warneken & Tomasello, 2009).

The second of these movements Tomasello called "group intention." It is in this that cultures grow. One of the effects of this movement has been to enable language, based on cooperative agreement: We agree that this sound means that and that another sound means something else.

May I suggest, then, that a third phase of the cognitive revolution will be based on the work of Tomasello and his group, which is perhaps the most important research in cognitive and comparative psychology of the 21st century. With a basis of seeing human beings as having evolved to be socially cooperative, research will become not just social, not just derived from threats and opportunities, but based on relationships in which what we do together is more

meaningful, and often more effective, than what we do just as individuals (see, e.g., Oatley, 2018).

How does cooperation, of the kind that Tomasello proposes, relate to deep machine learning? Here's a question. If you had a large computer, would it be better to build it into just one large artificial brain or into lots of smaller brains that communicate and cooperate with one another? The answer is likely to be that the many smaller communicative brains would do better, in an evolving culture (see, e.g., Bengio, 2014), because any one single brain can get stuck in a rut, a local minimum. Furthermore, how does this relate to Jung's ideas? Among the archetypes, the idea of "helper" comes close, but what about the idea of "partner"?

This new, third phase of the cognitive revolution may be the most important of all. If we look within the collective unconscious, we may discover hints in such phenomena as dreams, and in emotions that we don't fully understand, about being with each other, being together. A psychological understanding of this, perhaps hinted at in such phenomena, may help us humans in our struggle to move beyond mere individuality.

References

Bengio, Y. (2014). Evolving culture versus local minima. In T. Kowaliw, N. Bredeche & R. Doursat (Eds.), *Growing adaptive machines: Studies in computational intelligence* (Vol. 557). Berlin, Germany: Springer.

Frijda, N. H. (1986). *The emotions*. Cambridge, UK: Cambridge University Press.

Frijda, N. H. (2007). *The laws of emotion*. Mahwah, NJ: Erlbaum.

Frijda, N. H., & Parrott, W. G. (2011). Basic emotions or ur-emotions. *Emotion Review*, *3*, 416–423.

Gardner, H. (1985). *The mind's new science: A history of the cognitive revolution*. New York, NY: Basic Books.

Hinton, G. E. (2007). Learning multiple layers of representation. *Trends in Cognitive Sciences*, *11*(10), 428–434. doi:10.1016/j.tics.2007.09.004

Keltner, D., Oatley, K., & Jenkins, J. M. (2019). *Understanding emotions*, 4th ed. Hoboken, NJ: Wiley.

Lake, B. M., Ullman, T. D., Tenenbaum, J., & Gershman, S. J. (2016). Building machines that learn and think like people. *Behavioral and Brain Sciences*, *40* doi:10.1017/S0140525X16001837

LeCun, Y., Bengio, Y., & Hinton, G. E. (2015). Deep learning. *Nature*, *521*(7553), 436–444. doi:10.1038/nature14539

Lewis-Kraus, G. (2016, December 18). Going neural. *New York Times Magazine*, pp. 40–65.

McClelland, J. L., & Rumelhart, D. E. (Eds.). (1986). *Parallel Distributed processing: Explorations in the microstructure of cognition, Vols 1 and 2*. Cambridge, MA: MIT Press.

Oatley, K. (2018). *Our minds, our selves: A brief history of psychology*. Princeton, NJ: Princeton University Press.

Oatley, K., & Johnson-Laird, P. N. (1987). Towards a cognitive theory of emotions. *Cognition and Emotion*, *1*(1), 29–50. doi:10.1080/02699938708408362

Oatley, K., & Johnson-Laird, P. N. (2014). Cognitive approaches to emotions. *Trends in Cognitive Sciences*, *18*(3), 134–140. doi:10.1016/j.tics.2013.12.004

Panksepp, J., & Biven, L. (2012). *The archaeology of mind: Neuroevolutionary origins of human emotions*. New York, NY: Norton.

Simon, H. A. (1967). Motivational and emotional controls of cognition. *Psychological Review*, *74*(1), 29–39. doi:10.1037/h0024127

Tomasello, M. (2014). *A natural history of human thinking*. Cambridge MA: Harvard University Press.

Tomasello, M. (2016). *A natural history of human morality*. Cambridge, MA: Harvard University Press.

Warneken, F., & Tomasello, M. (2009). Varieties of altruism in children and chimpanzees. *Trends in Cognitive Sciences*, *13*(9), 397–402. doi:10.1016/j.tics.2009.06.008