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The emergence of humanity's self-awareness

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ABSTRACT

A fundamental difference between humans and other animals is that humans are highly self-aware while other complex animals are less so; and simple creatures like mosquitos are not self-aware at all. Some researchers believe that self-awareness is an emergent property of a complex neural network. If this is so, then high self-awareness should appear when a neural network approaches the complexity of the human brain (~90 billion neurons and 10^{14} synapses). If one takes a much broader view and considers all of humanity as a neural network, then today there are ~7 billion individual human elements, of whom ~3 billion are interconnected via computers, smart phones, tablets, and the Internet. By morphological analogy, as human interconnectivity continues to grow and strengthen, eventually humanity will approach ~70 billion interconnected humans, at which point we will become highly self-aware as a single human super-organism. This *organismal self-awareness* may manifest itself as the elimination of wars, hunger, and strife, and as the collaboration of all individual elements working together for the greater good of humanity. It is projected that this organismal self-awareness will occur between the years 2400 and 2600.

1. Emergence in systems

There are many definitions of "System." One that I like for its testable operational characteristics (Monat, 2015) states that a system:

a Is a group of interacting, interrelated, or interdependent parts.
b The parts form a unified whole.
c The *arrangement* of the parts is significant.
d It attempts to maintain stability through *feedback*.
e It has constraints.
f It has boundaries.

Using this definition, it is clear that all of humanity, taken together, can be viewed as a system: billions of individuals interact as part of humanity; various components play various roles in society; nations, villages, families, businesses, and individuals attempt to maintain stable, secure lives; we are constrained by resources and laws and bounded by physical, physiological, and psychological limits.

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Table 1
Examples of Emergence.

Natural	Man-Made
• Flocking of birds	• The meaning of words
• V formations of geese	• Traffic jam patterns
• Schooling of fish	• Reliability
• Ant colony structure	• Security
• Termite "cathedrals"	• Usability
• Pressure of gases	• Countries
• Entropy or disorder	• The power of religion to influence behavior

There are properties of systems that are not properties of their components, and that cannot be predicted from the properties of the components: "Emergent Properties." These emergent properties are a consequence of the ***relationships*** among system components and between system components and the environment (Beckenkamp, 2006; Johnson, 2006).

Camazine states that "Emergence refers to a process by which a system of interacting subunits acquires qualitatively new properties that cannot be understood as the simple addition of their individual contributions. Moreover, the rules specifying interactions among the system's components are executed using only local information, without reference to the global pattern. In other words, the pattern is an emergent property of the system, rather than a property imposed on the system by an external influence" (Camazine et al., 2001).

There are many examples of Emergence, both naturally-occurring and man-made (see Table 1):

Additional examples include the outstanding performance of sports teams with only average players, or of bands with only average musicians. Thus, emergent properties are neither planned nor designed; they just occur as a result of the relationships among system elements. If interconnected humans are viewed as the elements of a super organism (humanity) then emergent properties will develop (and many already have, per the table above). One of those emergent properties may be self-awareness.

2. Self-Awareness

Although there are many "soft" definitions of self-awareness, it is not operationally well-defined. Hofstadter (2007) equates self-awareness to consciousness. Jabr (2012) says that " . . . self-awareness is recognition of [one's] consciousness—not only understanding that one exists, but further understanding that one is aware of one's existence . . . . . to be conscious is to think; to be self-aware is to realize that you are a thinking being and to think about your thoughts." The Merriam-Webster Dictionary (2016) says that self-awareness is "knowledge and awareness of your own personality or character." Wikipedia (2016) states that it is the capacity for introspection and the ability to recognize oneself as an individual separate from the environment and other individuals. Farlex's Free Dictionary (2016) states that it is "awareness of oneself, including one's traits, feelings, and behaviors." The Oxford English Dictionary (2016) says that it is "conscious knowledge of one's own character, feelings, motives, and desires, as in 'the process can be painful but it leads to greater self-awareness.'" Pathway to Happiness (2015) argues that "**Self-awareness** is having a clear perception of your personality, including strengths, weaknesses, thoughts, beliefs, motivation, and emotions. Self-awareness allows you to understand other people, how they perceive you, your attitude and your responses to them in the moment." And "The Self-Awareness Guy" (2016) claims that "self-awareness is a state of being where you deeply understand your own thoughts, emotions and behaviors and how they affect you and the world around you." The last 2 examples, although non-technical, stress the importance of interactions with the external world. These definitions all have merit, but they are not operational definitions. They also are anthropocentric whereas non-humans may exhibit degrees of self-awareness. Further, the definitions suggest that self-awareness is either present or not, when in fact more likely it manifests itself in degrees along a continuum.

Several researchers have attempted to devise self-awareness measurement scales. Fenigstein, Scheier, & Buss (1975) devised a scale to measure self-consciousness (which is not quite the same as self-awareness). Their assessment focuses on human psychopathology and its treatment; it also confounds the measurement of self-awareness by including individual motives, needs, and values in the assessment. Trapnell and Campbell (1999) attempted to improve this metric by describing public and private self-consciousness, but their analysis also focuses on human psychopathology and its treatment; it is not useful for present purposes. Ashley and Reiter-Palmon (2012) developed a self-awareness metric; however it is more about the characteristics of *self-reflection* that yield good leaders. There is a need for a better definition of and metrics for measuring self-awareness.

I propose the operational characteristics of self-awareness described in Table 2. This table is consistent with those definitions presented above, but additionally it operationalizes the characteristics, generalizes them beyond humans, and represents self-awareness along a continuum, making it easier to measure the degree to which self-awareness is present.

Self-awareness is manifested to various degrees by various animals: some elements of Table 2 may be present fully, partially, or not at all. Most animals demonstrate characteristic #1 of Table 2. Some animals manipulate their environments and thus demonstrate #4. A common test of animal self-awareness is the "mirror test" (Gallup, 1970; Gallup, Anderson, & Shillito, 2002) in which the animal is presented with a mirror and its behavior is observed. Most animals initially display

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