Machine Dreaming

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INTRODUCTION

From the anthropomorphic perspective, dreaming is restricted to humans, the only organism with a cognitive processing system able to report what is perceived to be a dream. Dream equivalent processing as based on shared characteristics and human based definitions are, however, within the capacity of modern computer systems. In the human, dreaming and dream-like cognition is utilized in functions with individual and species survival value including: feedback into sleep-associated operative processing, emotional integration (particularly as part of the response to significant physical and/or psychological stress), alternative problem solving, threat avoidance, and creativity (Pagel, 2008; Revonsuo, Tuominen, & Valli, 2015). AI and other machine systems are being developed with the capacity for accomplishing dream-like mentation. This goal is not routinely stated and is in many cases not understood as part of the objective by the programmers and theorists involved in the process. But current predicate logic systems have demonstrated set limitations in their ability to function in the common-sense human environment (Parisi, 2007). Particularly in robotics, an obvious need has developed for systems able to integrate and interact better with humans in the same manner that humans interact with one another. In order for systems to function in the common-sense based human environment better than systems limited to predicate logic, they are likely to require the capacity for achieving human equivalent processing capabilities. As based on many of the defined criteria for dreaming, some current machine systems have been developed utilizing both hardware and software that can function in a dream equivalent manner.

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BACKGROUND: THE PROBLEM OF DREAM DEFINTION

Dreaming is an almost ubiquitous personal experience, and as such, many definitions for dreaming have been developed and routinely utilized. For each individual experiencing dreaming, the experience seems concrete and obvious. There has been a strong tendency for each individual dreamer to presume that what he or she experiences as a dream is the same for every other individual who dreams. However, what one individual understands to be a dream is often far different from what another experiences or construes to be a dream. This has led to a situation in which there are multiple definitions and no concrete or overall inclusive definition, so that for any group, a series of often different, recurring and set definitions are used for dream (Pagel & Meyers, 2002). This problem of confused and even contradictory definitions has led to significant problems for researchers and investigators in the fields of dream study. For the sleep physician dreams are sleep-associated mental activity. For the psychoanalyst, dreaming defined by bizarre and/or hallucinatory content occurs in both wake and sleep. For one group, dreaming is a state of consciousness. For the other, dreaming is a form or type of thought. In some epistemologies, even the oldest of definitions, such as the dream as a message from god, are still used and believed (Buckley, 2009).

The problem of definition was confounded further in the last decades of the twentieth century when a wide spectrum of neuroscientists and clinicians decided, despite a lack of experimental evidence, that the electrophysiological state of Rapid Eye Movement Sleep (REMS) was equivalent to dreaming. Defined as REMS,

dreaming apparently needed no further definition (Pagel, 2011). Aristotle described a definition as a description of the "essence or essential nature" of the topic and as such, each definition applies and reflects an aspect, an essence of the state (Eco, 1984). In an attempt at clarification, in the year 2001, a multi-specialty panel of dream researchers and therapists developed a multi-axis definition paradigm for dreaming (Table 1) (Pagel, Blagrove, Levin, et. al., 2001).

One approach that can be used to avoid the problems of definition is to limit an approach to the associated and describable characteristics of the state. Researchers avoid defining 'dream' and focus on measurable factors (variables) known to be associated with the state such as recall frequency, content, and reported effects on waking behavior (Pagel, 2014). Another approach has been to avoid defining dream by concentrating on the known components of the cognitive process such as the associative memories, emotions and non-perceptual imagery that characterize the dreams state. Computer systems can be utilized to create simulacrum dreamscapes that include these components that comprise a biologic dream. Such artificial dreams are the focus of human filmmakers. The limitations for this process are not technological, they are based on the limits of our current understanding of the state. Computer systems utilize such capacities at the human interface, and in the presentation of data.

We humans are prone to describing much that is important in our life experience as being 'like a dream.' Dreams can be viewed as 'pictured metaphors' and as such, these images in metaphor are the stuff of dreams (States, 1997). Metaphor can be used as Aristotle suggested, "to use metaphor well is to discern similarities (to see, and/or analytically get beneath the skin of something)." (Eco, 1984) Yet for dreams, comprised of many and diverse metaphors, the metaphors that we use for specific description are most often misleading, describing only limited aspects of the state. Such metaphors viewed as partial definitions are within the capacity of artificial intelligence (AI) systems.

Some machine based dream equivalents, particularly those based on definitions, are already part of the processing utilized by artificial systems. Some such as Internet based criteria are in the process of assessment, since the system has developed so quickly and with so few controls that it has become somewhat independent and opaque to our understanding. Others, such as the neural-net based systems in current development, give hints of a capacity for dream equivalence, but are able to function, at this point, only at minimalistic levels of consciousness. The interface systems are in some ways the most fascinating, producing shared dream creation and utilization between human and machines.

Table 1. Definitions for dreaming - a classification system paradigm

A Definition of Dream Has Three Characteristic Continua		
Wake/Sleep	**Recall**	**Content**
Sleep	No Recall	Awareness
Sleep Onset	Recall	Day-Reflective
Dreamlike States	Content	Imagery
Routine Waking	Associative Content	Narrative
Alert Wake	Written Report	Illogic
	Behavior	Bizarre/ Hallucinatory

Source: Pagel J. Blagrove M. Levin R. et. al., 2001

MACHINE DREAM EQUIVALENTS

Messages From God

Computers routinely access the operative instructions that are part of their programming. Many computer systems are interactive. As based on level of access, computers are far closer to their creators and controllers than most humans. These communications from interactive creators can be viewed from the machine perspective as messages from their gods. So defined, messages from the