

Explicit knowledge in dolphins?

Eduardo Mercado III^a and Scott O. Murray^b
^aCenter for Molecular and Behavioral Neuroscience, Rutgers University-Newark Campus, NJ 07102; ^bInstitute of Theoretical Dynamics, University of California, Davis, CA 95616. mercado@pavlov.rutgers.edu
www.cmbn.rutgers.edu/~mercado/welcome.html
smurray@itd.ucdavis.edu itd.ucdavis.edu/~murray

Abstract. The theoretical framework proposed by Dienes & Perner sets the wrong standards for knowledge to be considered explicit. Animals other than humans possess knowledge, too, some of which is probably explicit. We argue that a comparative approach to investigating knowledge is likely to be more fruitful than one based on linguistic constructs and unobservable phenomena.

We agree with Dienes & Perner (D&P) that there is no simple dichotomy between implicit and explicit knowledge and that the idea of characterizing knowledge along a scale of explicitness is worth considering in detail. The ambiguities associated with the explicit/implicit distinction and the need for more precisely defined classifications have been discussed extensively by other researchers (for a review, see Engelkamp & Wippich 1995). By decomposing knowledge in terms of parameters derived from the representational theory of mind, D&P hope to resolve these ambiguities, and thereby to provide a precise theoretical system for describing levels of explicit knowledge that can be consistently applied across various fields. The usefulness of their framework is limited, however, in that: (1) the linguistic/anthropocentric constructs they use to define knowledge, as well as levels of explicitness, make their theory applicable only to adult humans, (2) the criteria they endorse for experimentally identifying various levels of explicit knowledge are overly dependent on linguistic competence and unobservable phenomena such as consciousness, volition, and intention, and (3) it is unclear how one might distinguish between the explicitness of representations and the explicitness of retrieval and reporting mechanisms using their framework.

Knowledge research has focused almost exclusively on adult humans. Even studies of knowledge in children have primarily been concerned with identifying when and how adult-like (i.e., verbalizable) knowledge develops. We suggest that a comparative approach to understanding knowledge can provide a broader perspective on how brains encode, maintain, and retrieve information. Within the field of comparative cognition, for example, knowledge is described in terms of learned relationships between neural events (Olton et al. 1992; Roitblat 1987). These events can be generated by external stimuli (e.g., by sights or sounds) or they can be internally generated (e.g., producing movements or memories). Not only does this framework allow knowledge to be analyzed independently of verbal reports but it can also be mapped onto specific brain subsystems (Eichenbaum 1997; Merzenich & deCharms 1996; Squire 1992). Studies of knowledge in nonhumans offer greater objectivity because they are less likely to be corrupted by either introspection or linguistically based intuitions.

Distinctions between explicit and implicit knowledge in nonhumans are seldom made in the scientific literature. This is probably because explicit knowledge is typically defined in terms of consciousness, and most researchers are hesitant to make the as-of-yet empirically unsupported claim that any species other than *Homo sapiens* is "consciously aware." Instead, knowledge in nonhumans is often described as being either procedural or declarative (or as involving stimulus-response vs. stimulus-stimulus associations, or perceptual vs. conceptual representations, etc.). Animal cognition research focuses first on discovering what animals can represent (or know) and then on understanding how they represent this knowledge. D&P start with the assumption that knowledge is represented propositionally, and then seem to equate existence of a representation with explicitness of knowledge (e.g., in sect.2.1.3, they suggest that if the self is represented propositionally as knowing, then knowledge of a fact is fully-explicit). It seems unlikely that knowledge in nonhumans is exclusively propositional. Yet there is evidence showing that some non-human species use

meta-knowledge to guide their actions, suggesting that they can assess what they know.

For example, Smith et al. (1995) examined whether bottlenosed dolphins (*Tursiops truncatus*) would respond adaptively to uncertainty in a psychophysical test by escaping in the way that humans do. This study essentially asked, "Does the dolphin know when it does not know?" Smith et al. found that when a dolphin and humans were tested on an identical task their responses to uncertainty were nearly indistinguishable. These findings provide evidence that in certain situations dolphins may represent their own knowledge in ways comparable to humans. Do these findings provide evidence of attitude-explicit knowledge in dolphins? If not, why not? If so, does this imply that dolphins represent their uncertainty propositionally? Human subjects escaped when uncertain because that is what they were instructed to do. If asked why they escaped, they might say, "Because I was uncertain." Would this then show that the human subjects' knowledge was fully-explicit? If alternatively, a subject said, "Because you told me to," does this imply that his knowledge is only content-explicit?

Similar issues arise in studies of deferred imitation and action repetition. Dolphins and humans have both shown the ability to reproduce actions (on command) that they have observed or performed in the past (Bauer & Johnson 1994; Mercado et al. 1998, 1999; Xitco, 1988). How explicit is the knowledge involved in such tasks? Does deferred imitation involve (or require) conscious recollection, episodic memories, intentional retrieval of those memories, and voluntary reproduction of the recalled actions? Introspection might lead one to conclude that imitation of actions does involve such processes. Certainly if someone were to describe verbally the actions they had observed, this would be viewed as compelling evidence of fully explicit knowledge of the events. How would a reenactment be any less compelling? Yet when the organism doing the imitating is a dolphin, the tendency is to view these performances as merely showing evidence of innate abilities (i.e., fully implicit knowledge) rather than evidence of explicit knowledge. These examples illustrate some of the difficulties associated with determining what information is explicitly represented.

The explicit/implicit distinction was originally introduced as a way of distinguishing between different ways of retrieving or expressing knowledge (in particular, memories). D&P attempt to generalize this distinction to the representation or encoding of knowledge. Cognitive neuroscience studies have provided evidence that explicit retrieval tasks activate brain regions that are not activated in implicit tasks (Badgaiyan & Posner 1997). Differences in neural activation have also been observed in tasks involving deep versus shallow encoding (Buckner & Koutstaal 1998). Such neural correlates could greatly facilitate comparative research if nonverbal analogs of current implicit and explicit tasks could be developed. Theoretical descriptions of the relative explicitness of the encoding and retrieval of information will be much more useful when they can be grounded in empirical observations that are not species- or task-dependent.

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