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Commentary on: *How to learn about teaching. An evolutionary framework for the study of teaching behavior in humans and other animals*, by Michelle Ann Kline.

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Learning in and about opaque worlds

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Abstract

We argue that direct active teaching in humans exhibits at least two properties (open-endedness and content opacity) that make the recognition of teaching episodes without ostension untenable. Thus, while we welcome Kline's functional approach to the analysis of teaching, we think that she ignores important features of the socio-environmental niche in which human teaching likely evolved.

Main text

We applaud Kline's explicitly functionalist approach to the topic of teaching. While somewhat reminiscent of the model proposed by Hoppitt et al. (2008), the classification of the types of teaching that Kline charts out in the present paper is primarily dependent on the range of adaptive problems that social learners may face. This allows the author to discuss the design features that each teaching type exhibits in terms of the adaptive problem that it purportedly evolved to solve (e.g., limited motivation to attend to relevant information). A rigorous application of this genuinely Darwinian approach could indeed bridge the study of the taxonomical distribution of teaching behaviors and that of the socio-environmental niches where particular types of teaching are observed and likely evolved.

We think, however, that Kline's characterization of 'direct active teaching' (DAT) in humans may fall short of adequately describing the mutual evolutionary dependency between species-typical psychology and adaptive niche that her framework rightly champions. As Kline notes, DAT "does not require ostensive cues (at least by definition)" - in other words, it does not require the teacher to explicitly mark her demonstration as a teaching attempt, addressed to specific a pupil. This could indeed be the case when there is some "shared background knowledge" that the pupil could rely on to interpret the teacher's demonstration as communicating to-be-learned information. Articulating Kline's intuition, one could imagine such background knowledge as consisting of species-typical sensitivity to fitness-

relevant action outcomes, in which the causal relations the pupil is unable to entertain and appropriately reconstruct via asocial learning mechanisms. Alternatively, this background knowledge could also be established by explicit linguistic communication, e.g., by informing the putative pupil that a subsequent demonstration would constitute a teaching episode. In either case, the function of DAT could be potentially realized without the need of ostensive communication. Tellingly, however, these hypothetical scenarios could dispense with ostension only by assuming (in the first case) that the set of fitness-relevant information that a given species needs to acquire is narrow in scope and fixed in content; or, alternatively, (in the second case) that the pupil's expectations could complement the pedagogical stance of the teacher only if both parties are capable of linguistic communication. Neither of these trade-offs seems to constrain DAT in humans: the domain of teaching is clearly open-ended, and its receptivity, as a large volume of developmental evidence shows, well predates the understanding of language. How could this be?

Klein is keenly aware of the learnability challenge that this open-endedness poses: "the pupil has no way to solve the 'frame problem' by observing others' behavior" and "Her only indication that information is relevant comes from the teacher." Thus, given that DAT is fundamentally characterized by "(a) manifestation of relevant information by the teacher to the pupil, and (b) interpretation of this manifestation in terms of knowledge content by the pupil," and that — at least in humans — the second condition could not be

satisfied by simply recovering pedagogical intentions from the (perceived) fitness relevance of the demonstrator's behavior, something else is required.

As argued elsewhere (Csibra & Gergely, 2009; 2011), a candidate solution to this problem is ostensive communication. The design features that ostension exhibits – in terms of the cognitive effects it produces in the pupil – in fact tailored to solve the problem of communicating about the occurrence of relevant, to-be-learned knowledge content. Rather than merely attracting the attention of the pupil towards certain objects, actions, or locations, together with making manifest to the pupil that she is the intended addressee of the demonstration, ostension restructures the relevance assumptions governing the pupil's learning in more fundamental ways. It allows the pupil to acquire the content of a culturally transmitted behavior that may to a large extent remain cognitively opaque in terms of its underlying causal and teleological structure. Similarly to epistemic deference (Gergely & Jacob, 2013; Sperber, 1997), ostension allows for the acquisition of (generic) knowledge contents that are not only functionally non-transparent, but that do not seem to have any perceivable fitness value. This *prima facie* puzzling susceptibility, which clashes against a cognitive economy rarely prioritizing the encoding of opaque information in non-communicative contexts, is revelatory of the type of evolutionary challenge that favored the selection of this mechanism.

As Kline writes, “our species depends to a great degree on cumulative cultural adaptations too complex for any one individual to create on his or her own.” Our fundamental reliance on opaque (material and social) kinds cries

out for an explanation of how human cognition succeeded in stabilizing the transmission of cultural items such as artifacts and conventions, which are opaque through and through. This unprecedented evolutionary challenge was partly overcome, we believe, by evolving cognitive adaptations that would allow for the interpretation of communicated information as being applicable beyond its local and episodic use. This is precisely the type of inference that ostensive signals license about demonstrated content. Therefore, if human teaching is to be portrayed as a glaring exception in the animal kingdom, this is not, or not solely, because of its frequency and breadth of use, but rather because of its capacity to perpetuate cultural kinds that are causally and teleologically opaque. To emphasize this aspect is to highlight the irreplaceable role that ostension plays in DAT for humans.

Thus, while endorsing and strongly encouraging the application of the framework that Kline laid out, we also think that more weight should be assigned to ostensively grounded teaching. This, if anything, could only enrich Kline's functionalist agenda by adding a further adaptive problem — learning in and about, and in spite of, a culturally opaque environment — to her articulated classification, while doing proper justice to the idea of “cultural niche” (Boyd et al., 2011).

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