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Douglas Medin and Sandra Waxman

Giyoo Hatano

Leonardo daVinci would probably be mystified by the attention we devote to the smile on the face of the young woman that we have come to know as Mona Lisa. In this richly detailed portrait, *La Gioconda*, DaVinci depicted the wife of Francesco del Giocondo. For daVinci, art historians, and presumably del Gioncondo himself, Mona Lisa's smile is but one among the many admirable facets of this Renaissance painting. Just so, those of us commenting on any one facet of Giyoo Hatano's prodigious research contributions, do so at the risk of losing sight of the larger picture of his life's work, its balance and the signature that he has left in Cognitive Science. Dr. Hatano was a deeply respected cognitive scientist of international renown. Unlike most cognitive scientists, who work within a home discipline and sometimes venture into a nearby discipline, Dr. Hatano followed his curiosity into virtually every discipline within cognitive science. His contributions stand out for their intellectual breadth and clarity. His signature on the field is the fluidity and rigor with which he was able to integrate his clear theoretical vision, methodological precision and commitment to application.

In this tribute we focus primarily on the facet of Dr. Hatano's contributions that have been most visible to us, his work on children's understandings of biological phenomena, including the plants and animals that they encounter and the ways in which they reason about them. Much of this work was carried out in collaboration with his long-time colleague, Kayoko Inagaki. This body of research is itself, multi-faceted, addressing two central questions: 1. When does biology emerge as a distinct cognitive domain for children? 2. What is the role of experience in the development of children's biology?

<u>Biology as a domain.</u>

Many current researchers have advanced the theory that cognitive development proceeds, at least in part, on the basis of innate or rapidly-developing skeletal principles and that these may be domain-specific and theory-like. These skeletal or core principles guide the process of acquisition in core domains and facilitate learning. Candidate domains include language, naïve physics, naïve psychology (theory of mind) and naïve biology. Working within this theoretical framework, some prominent researchers, including Susan Carey, have argued that one domain (naïve biology) is a relatively late conceptual achievement and that it grows out of a different domain (naïve psychology). A strong suit in this argument was evidence suggesting that children from 5 to 8 years of age show no evidence that they invoke reasoning strategies or causal mechanisms that are unique to biology.

Hatano and Inagaki (Inagaki and Hatano, 1993, 1996, Hatano and Inagaki, 1999) were captivated by this issue and launched a research program that bore the Hatano signature. Blending clear theoretical commitments with precise experimental methods, they demonstrated that 5 to 8 year old children are able to explain bodily processes in terms of a vitalistic causality. They further revealed that children's vitalistic causality relied on energy principles, and was therefore based in biological and not psychological reasoning. This work was influential because it suggested that children's understanding of biological phenomena emerges earlier than we had previously thought and it suggested that children's knowledge and reasoning about biology is autonomous, and does not arise from their reasoning about psychology.

<u>The role of experience in the development of biological knowledge.</u>

Any comprehensive theory of development must take into account not only knowledge or structure that is present in the mind of the learner, but also how this knowledge advances with experience. Although there have been theoretical tugs-of-war concerning the relative contributions of 'nature' and 'nurture', the very best developmental work considers these to be complementary. Hatano and Inagaki's work is an excellent example of this complementarity. Having identified the biological knowledge held by young children, they went on to consider whether and now this knowledge was influenced by experience. They considered both experience with biological entities and experience with language as sources of input to the developing child.

<u>Experience with biological entities</u>. In one of the most clever programs of research in cognitive science, Inagaki and Hatano (Inagaki, 1990, Hatano and Inagaki, 1992, Inagaki and Hatano, 2002) examined the cognitive consequences of experience

with biological entities on the development of biological knowledge. They studies urban Japanese children's experience in raising goldfish. They found that children who were given an opportunity to raise goldfish were able to use goldfish as an analogical base for generalizing biological knowledge to other animals. This finding was influential because it raised the possibility that the propensity of young children to use humans as a base for inductive generalization may be driven by knowledge about humans rather than failure to distinguish naïve psychology from naïve biology. This work was also the impetus of a later series of studies on the role of expertise and culture in children's biological knowledge and reasoning (summarized in Medin and Atran, 2004).

Language and the development of biological knowledge. In another series of studies, Hatano and his collaborators considered the role of language on the development of biological knowledge. Although many biological categories are named, although children rapidly acquire names for things, and although naming has strong conceptual consequences, the role of linguistic categories in the development of children's biological concepts had generally been ignored. In a pioneering cross-national study Hatano and his collaborators (Hatano, et al, 1993) provided suggestive evidence that children's concepts of what kinds of things are *alive* are affected by the naming patterns of their native language. This finding inspired Waxman and her associates (Waxman, 2005, Angorro, Waxman, and Medin, 2005) to perform a series of cross-linguistic and cross-cultural studies concerning how systems of taxonomic terms can influence the emergence of children's understandings of biological properties (such as "alive").

In summary, Dr. Hatano's pioneering work on children's biological knowledge and reasoning has been exemplary for its insight and precision. It has moved the field forward, and it has influenced strongly our own programs of research.

These outstanding research contributions go hand in hand with Giyoo's personal qualities. He was warm, charming and full of vitality. He had the wisdom to choose fundamental areas of research, the acumen to notice fault-lines within a line of research, and the generosity to expose these fault-lines in a way that sounds like a compliment. And it was a compliment that Professor Hatano would direct his vital energies so selflessly to make other people's research better. Giyoo was the ideal guest at workshops and a most gracious participant at conferences. We always looked forward to interacting with him at conferences. He was also the ideal host, generously and warmly supporting his friends' and colleagues' hopes of visiting Japan. When SRW's nephew traveled through Asia, Dr. Hatano welcomed him into his home. When the Japanese Society for the Promotion of Science generously provided support for DLM to visit Japan, Dr. Hatano was his host. Dr. Hatano was thoughtful and attentive for both the official activities and for our "free time" when we were able to visit Japan's beautiful countryside and ancient cities. It was also a delight to see that Dr. Hatano was as deeply respected in Japan as he was in the rest of the world. He was a good friend, an outstanding colleague and he will be missed.

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