

Book Review: Geoffrey B. Saxe, *Cultural Development of Mathematical Ideas*. Cambridge University Press, Cambridge, 2012.

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In his latest book, ethnographer Geoffrey Saxe offers a comprehensive treatment of social and linguistic change in the number systems used for economic exchange in the Oksapmin community of Papua New Guinea, whose traditional 27-body-part counting system and barter-based economy are being altered through exposure to Western numbers and monetary exchange. Drawing upon an extensive body of data, Saxe documents change in the forms and functions used to represent numbers by the Oksapmin people, situating the development of cultural ideas about numbers in the dynamic interactions of individuals, practices, and conventions. Saxe presents diachronic change by comparing the data he has collected over more than three decades of field research, while synchronic variation is determined by comparing demographic differences between elders and youths or between groups with varying degrees of exposure to Westernized education and economy. Each research task is well described in terms of the participants, procedures used, and results obtained, with thoughtful analysis of any artificialities or constraints (e.g., language and cultural differences reducing task comprehension; demand characteristics with the potential to influence behavioral outcomes).

Saxe's stated goal is to illuminate the relationship between cognition and culture. He chooses an interesting and innovative approach to the cognitive component by locating it in the social practice and reproduction of collective knowledge. This necessitates a focus on group processes, such as the one whereby terminology (e.g., terms for monetary denominations) shifts from a multiplicity of individualized names to a more limited set of conventionalized ones, or more individualized processes, whereby knowledge is transformed. For example, some individuals performing addition or subtraction changed traditional body-counting through emergent strategies of double enumeration, enabling them to keep track of both augend and addend or minuend and subtrahend; the likeliness and success of these strategies were closely tied to participants' experience with Western mathematics and money. Younger participants with greater exposure to Western education or those who participated to a greater extent in Westernized forms of economic exchange were more likely to invent and use double enumeration. Other individuals changed the upper limit of the number system—*fu*, a term loosely translated as 'finished'—from 27 to 20, representing the incorporation of a feature of the Western monetary system.

By taking the cognition-is-social approach, Saxe positions himself within emerging perspectives that view cognition as enacted (i.e., the hypothesis that cognition is organized through active engagement with the environment), situated (contextually bound, particularly to culture), and extended (produced by the interaction of brains, bodies and the environment). Social interaction is, after all, a mechanism whereby collective knowledge is shared, reproduced, and transformed. The approach is somewhat risky in that sociality surely does not exhaust cognition, however central or critical a role the social dimension might have. Brains, bodies, and materiality also contribute to cognition—causally at least, and possibly constitutively as well—as

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has been argued by philosophers such as Andy Clark and David Chalmers and archaeologists such as Colin Renfrew and Lambros Malafouris. Since traditional Oksapmin counting involves the body as both an expressive medium and the physical substrate for enumeration, the Oksapmin number system represents an opportunity for insight into the role of embodiment in mathematical expression and the nature of numerical invention, sadly not explored in the present work. Saxe also omits much treatment of the psychological processes implicated in numeric cognition: numerosity, attention, working memory, abstraction, categorization, and so on. Double enumeration, as a strategy that requires an individual to retain a number in mind while mentally manipulating an ordinal sequence representing a second number, has the potential to challenge both working memory and attention, whose capacities might therefore be predicted to constrain the extensibility of double enumeration to arithmetic problems of greater complexity than those tested by Saxe, an implication he unfortunately does not address.

Saxe also assumes that “the artifacts that are constitutive of emergent numerical problems in exchange, the cash and commodities, have no inherent numerical or exchange value” (p. 23). This view necessarily privileges linguistic signs over material ones, ignoring the fact that material objects instantiate numeric value in a manner that is tangible, durable, and nonlinguistic (what Malafouris, 2013 refers to as material semiosis). While Saxe’s approach undoubtedly avoids both the pitfalls of neurocentrism and any relativistic squeamishness about biological explanations (e.g., Tallis, 2011; Bloch, 2012), it may leave the reader wondering whether, for all the work’s purposed discussion of cognition, the brain had any role whatsoever. Admittedly, these criticisms are perhaps more justly leveled at the discipline, not an author who has rather skillfully managed to sidestep or balance the major concerns.

Overall, though Saxe might have done even more with his fascinating topic, his book makes an important and valuable contribution to the understanding of numeric cognition in documenting the transformative events underlying cultural change, as well as explaining the theory and methodology of understanding the relation between cognition and the social dimension of cognition.

References

Bloch, M. (2012). *Anthropology and the cognitive challenge*. Cambridge University Press, Cambridge.

Malafouris, L. (2013). *How things shape the mind: A theory of material engagement*. MIT Press, Cambridge, MA.

Tallis, R. (2011). *Aping mankind: Neuromania, Darwinitis and the misrepresentation of humanity*. Acumen, Durham.