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Bartlett, Functionalism, and Modern Schema Theories

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This commentary concludes that Bartlett took a functional approach to psychological theory. He hypothesized that schemata are active, holistic, unconscious, and show emergent properties. He provided no mechanism for going from episodic instances to a holistic schema or for the long-term retention of information in memory. Modern schema theories reject Bartlett's holism and interpret his hypothesis that schemata are active in terms of the active nature of top-down processes in memory and perception. Modern schema theories use the construct of instantiation to account for memory of specific schema-related information and also postulate unconscious, generic memory structures to account for the impact of old knowledge on human cognitive processing.

Commenting on Iran-Nejad and Winsler's paper, "Bartlett's Schema Theory and Modern Accounts of Learning and Remembering" has been very helpful to my own thinking. Their analysis of Bartlett and their own theoretical proposals are quite different from my previous work on these issues (Brewer, 1999a, 1999b, 2000; Brewer and Nakamura, 1984), so in responding to their paper I was forced to go back and examine the basic assumptions underlying my previous writing about Bartlett and schemata. In this commentary I will first analyze Iran-Nejad and Winsler's reinterpretation of Bartlett, then I will analyze their interpretation of modern schema theory, and finally I will briefly examine their alternative proposal.

Interpretations of Bartlett's Schema Theory

In this section I will first discuss those aspects of Iran-Nejad and Winsler's interpretation of Bartlett where we agree. We agree that one of Bartlett's major goals was to show how *previous knowledge* influences current mental processes (Brewer and Nakamura, 1984, p. 122; Iran-Nejad and Winsler,

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2000, p. 5). We agree that Bartlett was strongly *anti-associationist* (Brewer and Nakamura, 1984, p. 128; Iran-Nejad and Winsler, 2000, p. 10). We also agree (Brewer and Nakamura, 1984, p. 122; Iran-Nejad and Winsler, 2000, p. 11, 19) that Bartlett thought that schemata showed *emergent* properties — that schemata were qualitatively different from the elements that went into their construction (e.g., Bartlett, 1936, p. 49). Iran-Nejad and Winsler (p. 19) make this point through the use of J.S. Mill's mental chemistry analogy that water is qualitatively different from the components hydrogen and oxygen.

There are several issues where we partially agree, but show some differences in interpretation. First there is the issue of the *active* nature of schemata (Brewer and Nakamura, 1984, p. 123; Iran-Nejad and Winsler, p. 19). It is clear that Bartlett considered schemata to be active; however it is not completely obvious what he meant by this term. For example, in discussing the inferences he found in his story recall data, he stated "the process is emphatically not merely a question of relating the newly presented material to old acquirements of knowledge . . . . To speak as if what is accepted and given a place in mental life is always simply a question of what fits into already formed apperception systems is to miss the obvious point that the process of fitting is an active process, depending directly upon the pre-formed tendencies and bias which the subject brings to his task" (Bartlett, 1932, p. 85). In my recent chapter on Bartlett (see Brewer, 2000) I argued that the point Bartlett was making by asserting that schemata are active is that humans are not passive responders to physical stimuli, but actively use their past knowledge in dealing with the world. In the terms of modern cognitive psychology, Bartlett was emphasizing the top-down aspects of human cognition. This interpretation is also supported by Bartlett's account of the "effort after meaning" in various psychological tasks (1932, pp. 20, 227).

I think Iran-Nejad and Winsler would agree that my account captures one aspect of Bartlett's use of the term "active," but I suspect they would prefer to give an even larger role to active processes. In light of their arguments I have decided to supplement my earlier interpretation with an additional way in which Bartlett used the term "active." Bartlett's memory data showed changes over repeated recalls. In a number of places Bartlett criticized the notion of recall as merely the retrieval of "fixed and changeless 'traces'" (e.g., 1932, p. vi). In these cases I think Bartlett was using the term active in a second sense to capture his belief that schema-based processes continued to operate on memory over time. For example, Bartlett stated "schemata are . . . living, constantly developing" (1932, p. 200). I believe Iran-Nejad and Winsler would also agree with this extension of my interpretation of Bartlett, but would consider that my analysis still provides too limited a role for active processes. However, I think that the two uses of active just outlined capture most of Bartlett's discussions of the active nature of mental processes.

Another topic on which we have partial agreement is the issue of atomism. We both agree that Bartlett was *anti-atomistic* (Brewer and Nakamura, 1984, p. 123; Iran-Nejad and Winsler, pp. 18, 31). However, I think Iran-Nejad and Winsler go on to make a stronger claim — that Bartlett supported *holism*, which I take to be the position that phenomena must be studied as wholes and that attempting to isolate psychological phenomena is an inappropriate research strategy. After a careful reading of the relevant passages in Bartlett, I have come to believe that Iran-Nejad and Winsler are probably correct in their interpretation. In particular, I take the following two quotes as strong evidence that Bartlett was advocating some form of holism with respect to his schema construct: Bartlett (1932) wrote, "the past operates as an organized mass rather than as a group of elements each of which retains its specific character" (p. 197) and "[past experiences] operate, not simply as individual members coming one after another, but as a unitary mass" (p. 201). I think this interpretation of Bartlett is further supported by his arguments against the research strategy that involves the "isolation of response" (1932, pp. 2, 6).

I differ with Bartlett and with Iran-Nejad and Winsler on the holism issue. It seems to me that holism suffers from a number of fatal difficulties. First, analysis has turned out to be a very powerful tool in the history of science. Second, I think most complex psychological phenomena have an underlying structure that can be analyzed. Third, it is the holistic assumption that leads Bartlett's schema theory into the awkward position of not being able to account for any form of specific recall (cf. Brewer's account of the "pure schema model," 2000, pp. 81–82; Brewer and Nakamura's discussion of "pure reconstructive recall," 1984, pp. 124–125; and Iran-Nejad and Winsler's summary of the argument, p. 22).

Unpacking the issue of holism has made me aware of an error in one of my recent papers on Bartlett's schema construct (Brewer, 2000). In that paper I state that Bartlett's difficulty with instances was due to his "*abstractionism*." In adopting this term I was assuming that Bartlett believed that schemata were acquired by a standard process of abstraction across instances, but I can find no textual support in Bartlett's published work that he postulated an abstraction process. I now think that Bartlett simply did not provide a psychological mechanism for going from individual instances to the holistic schema. I think Bartlett was aware of this difficulty since at one point he made fun of his theory and stated that a critic might say that it "merely jumbles together innumerable traces and calls them 'schemata'" (1932, p. 214).

Iran-Nejad and Winsler emphasize the role of *biology* in Bartlett's thinking (pp. 18–20). In my recent (Brewer, 1999a) biographical piece on Bartlett I also discuss the role of biology in Bartlett's thinking, but argue that, in practice, biological ideas played a limited role in his work (cf. Broadbent, 1970, p. 8, for a similar argument).

Now I want to turn to two issues on which Iran-Nejad and Winsler and I strongly disagree. One of the core arguments in Iran-Nejad and Winsler's paper is that, for Bartlett, schemata are not passive structures in long term memory but are "*transient functional patterns*." I think a careful study of Bartlett shows that Iran-Nejad and Winsler (2000, p. 10) are correct in their assertion that "Bartlett never uses any long-term storage metaphors in his account of schemata." However, a careful reading of Bartlett on this issue is a two-edged sword since he also never discusses any transient functional mechanisms. A close reading of Iran-Nejad and Winsler's paper shows that they repeatedly ascribe the transient position to Bartlett but rarely back it up with quotes. The two quotes they do provide (Bartlett, 1932, pp. 201, 203) each use the phrase "doing something all the time" where "all the time" clearly indicates something that is *not* transient. Ironically, the quote they cite from page 203 is part of a discussion in which Bartlett is attempting to account for (non-transient) scripted, sequential, rote memory. I think what is going on here is that once again Bartlett had no theoretical proposal for how information is retained over long periods of time. Given this gap, some modern schema theorists have imposed a storage metaphor on Bartlett while Iran-Nejad and Winsler (2000) have imposed Iran-Nejad's (1987) transient structures. If one were allowed to be anachronistic, I believe that Bartlett would have liked Hebb's (1949) proposal which accounted for stable memories through a process of continuing activity.

Finally I turn to the issue of *unconscious mental structures*. In Brewer and Nakamura (1984) we state "The hypothesis that schemas are complex unconscious knowledge structures is one of Bartlett's major contributions" (p. 121). In the present paper, Iran-Nejad and Winsler state "Bartlett (1932) [did] not view schemas as unconscious structures but he, like Head, equated cognition with awareness" (p. 21). Clearly we have dramatically contrasting interpretations of Bartlett on this issue. I believe the textual evidence strongly supports the view that Bartlett hypothesized that schemata are unconscious. In presenting the data of his experiments, Bartlett (1932) repeatedly discussed the unconscious operation of schemata (pp. 52, 68, 86, 94, 126). [Bartlett typically uses the term "unwitting" as his term for unconscious.] For example, Bartlett (1932) stated "That this unwitting selection of central facts does occur is shown clearly in every series which I have obtained . . . . The selection of material . . . is not, except in unusual cases, carried out consciously" (p. 126). In a discussion of top-down processes in perception, Bartlett (1932) stated "though it is active it is not conscious" (p. 20). Bartlett made the same point in his more general theoretical accounts of his approach. For example, in his discussion of Head's concept of schema, he noted that "schemata are active without any awareness at all" (1932, p. 200). Finally, in his autobiography, Bartlett (1936) reflected on his schema con-

struct and stated that when an individual uses a schema "He is not able to describe this scheme as something that he can find by introspection, but it has a character theoretically the same as other things, e.g., images, sensory patterns, ideas, and so on, that he is able to find in this way" (p. 47). I think this set of quotes makes very clear that Bartlett thought schemata typically operate unconsciously (though he allowed for the possibility that they could occasionally be brought into consciousness).

Bartlett and Functionalism

Iran-Nejad and Winsler argue that Bartlett's views are those of a functionalist. They are not the first to make this point (cf. Boring, 1950, p. 559); however I think they do a valuable service to the field to use the functionalist framework to try to understand some of the difficult aspects of Bartlett's work. I would like to continue their lead and try to make the connection a little more explicitly. Functionalism was a somewhat ill-defined movement, but there is some agreement about the characteristics of those psychologists who were called functionalists (cf. Boring, 1950; Leahey, 1997; Lundin, 1996; Marx and Hillix, 1973). Members of this movement tended: (a) to view the mind as a form of *biological adaptation*; (b) to take a *holistic* approach and be opposed to elementism; (c) to adopt some form of *act* psychology — preferring to look at psychology in terms of processes instead of structures; (d) to emphasize the *utility of consciousness;* (e) to be opposed to grand theories and take an *eclectic* theoretical approach; (f) to define psychology *broadly* to include the study of children, individual differences, abnormal individuals, and animals; and (g) to apply psychology to *socially useful* tasks. I think the interchange between Iran-Nejad and Winsler and myself makes it fairly clear that Bartlett adopted the functionalist position on the first four issues, and an examination of his overall career (e.g., Brewer, 1999a) shows that he also took the functionalist position on the last three issues. Clearly I agree with Iran-Nejad and Winsler that Bartlett was a functionalist and if I were to write a general biographical piece on Bartlett in the future, I would use this interpretation to help frame his work.

Modern Schema Theory

I agree in large part with Iran-Nejad and Winsler's characterization of modern schema theory. Modern schema theory is focused on the problem of how previous knowledge impacts current mental processes. It assumes that generic knowledge of the world is represented in unconscious mental structures (schemata). The old knowledge represented in the schemata interacts with incoming specific information through a process of schema instantiation.

The interesting question raised by Iran-Nejad and Winsler is — why are there discrepancies between Bartlett's position and modern schema theory? In Brewer (2000), I point out that Bartlett's memory data were gathered 15–20 years before the publication of his 1932 book and that he originally interpreted his data in terms of a much more static notion — the anthropological construct of conventionalization (culturally stable patterns). In writing his 1932 book, Bartlett adopted a strong form of functionalism as embodied in the schema construct, yet he left the descriptions of his data essentially unchanged from his earlier publications. Thus, it seems to me that the data and the descriptions of the data are not completely compatible with the extreme functionalist theory he presented in Chapter 10 of his book.

Modern schema theorists have tried to develop an internally consistent theory that captures Bartlett's data and omits some of the more extreme aspects of his functionalism. They have interpreted his act psychology in terms of the active nature of top-down processes in memory and perception, and in terms of the active nature of the reconstructive processes in memory. They have rejected the extreme version of holism and have assumed that schemata have structure, and they have introduced the process of instantiation to allow schema theory to deal with particulars. In keeping with Bartlett's anti-atomism they have advocated the study of more complex, ecologically valid tasks. They have accepted his position that schemata show emergent properties and thus have argued against more atomistic approaches in favor of molar approaches to knowledge representation. They have accepted his view that schemata tend to operate unconsciously. Finally, they have assumed that schemata encode generic knowledge so that schemata will be able to give an account of Bartlett's basic memory data (transformations to the familiar and inferential reconstructions based on previous knowledge).

Iran-Nejad and Winsler make a number of criticisms of modern schema theory, but miss the one that I consider the most damaging. In several papers (Brewer, 1987, 2000) I have argued that modern schema theory tends to equate generic knowledge with *all* knowledge. Thus, it is unable to account for nongeneric forms of structured knowledge (e.g., the types of knowledge often represented by mental models or naive theories).

Functional Schema Theory

This is not the place for a full discussion of Iran-Nejad and Winsler's positive alternatives to modern schema theory; however I will discuss a few core issues. I do not see how their theory can account for the recall of specific memories over long periods of time. For example, I recall having a discussion with Ali Iran-Nejad in the card catalog room of the main library at the University of Illinois. This is a specific memory that is now almost twenty

years old. In their paper, Iran-Nejad and Winsler (p. 10) criticize Neisser for stating that human beings store information about their past experiences. I, for one, stand with Neisser on this fundamental point.

I also do not see how their theory can account for Bartlett's memory data. These data show powerful effects of past knowledge on recall, and this is why modern schema theory postulates generic knowledge structures. How do the transient schemata account for these data?

Iran-Nejad and Winsler apply their psychological holism to brain neurophysiology and adopt a mass-action theory of brain function (p. 30). This approach seems to me to be completely incompatible with the findings of cortical modularity and specificity of function in contemporary cognitive neuroscience.

Finally, I think it would be instructive for Iran-Nejad and Winsler to provide an account of how their approach relates to connectionist theories. Connectionist models of schemata have been developed and these models are biologically based, active, holistic, have no stored memory structures, require no executive, and have a natural acquisition mechanism. Clearly the connectionist approaches have most of the characteristics Iran-Nejad and Winsler want in a schema theory. I presume that they are reluctant to embrace the connectionist approach because these models capture old knowledge in terms of the strengths of associations and thus are strongly associationist. I think a discussion of these issues would help clarify the functional schema theory.

Conclusion

Overall, I think this interchange has been very valuable. It seems to me that the discussions of our very different interpretations of Bartlett result in a much deeper understanding of Bartlett's position. And our exchanges over the nature of modern schema theory clarify the nature of that theory and show where that theory has adopted Bartlett's position and where it has diverged.

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