In Response

Relational Frames: Where Do They Come From? A Comment on Barnes-Holmes and Hayes (2003)

Mark Galizio
University of North Carolina at Wilmington

Book reviews can serve multiple functions. One goal of my recent review of the Hayes, Barnes-Holmes, and Roche (2001) book (Galizio, 2003) was to increase awareness of this important work in the general behavior-analytic community. The implications of relational frame theory (RFT) and the growing literature on stimulus relations are quite broad and have the potential to make an impact on many areas of behavior analysis. A second purpose was to identify several problematic issues that appear to require further theoretical and empirical attention. With respect to this second goal, Barnes-Holmes and Hayes' (2003) reply was most gratifying, not only because of its gracious tone, but also because they addressed a number of issues that I consider critical. Their clarifications and corrections of several of the interpretations made in my review are much appreciated. However, with respect to problems concerning the origins of relational operants and the account of transformation of function, their reply raised further questions, and I welcome the opportunity to develop some of these here.

Acquisition and control of relational operants. The basis of RFT is the higher order, relational operant: the relational frame. Hayes, Fox, et al. (2001) define a *relational frame* as a "specific

class of arbitrarily applicable relational responding that shows the contextually controlled qualities of mutual entailment, combinatorial mutual entailment, and transformation of stimulus functions" (p. 33). Their book provides a powerful statement of the utility of the relational frame to interpret complex human behavior as well as to generate new and exciting directions in behavioral research.

Relational frames are purely functional operants with no consistent topographical features. Of course, the definition of a response class in terms of its functional properties (and not its topography) is basic to behavior analysis, and RFT theorists have consistently made it clear that, as Barnes-Holmes and Hayes remind us in their reply, "No new type of operant is supposed by these terms—the qualifiers [higher order, overarching, purely functional] are merely to avoid confusion" (Hayes, Barnes-Holmes, & Roche, 2001, p. 147). However, relational frames, along with many other higher order operants, *have* been granted some special properties, arguably differentiating frames from other forms of operant behavior, as the authors acknowledge elsewhere in the book: "We believe, however, that relational frames involve a new type of generalized operant. We say new, because the instrumental behavior of relational framing alters the functions of behavioral processes" (Hayes, Fox, et al., 2001, p. 45). I noted that a number of questions surround the empirical and theoretical

Correspondence concerning this article should be addressed to Mark Galizio, Department of Psychology, University of North Carolina at Wilmington, Wilmington, North Carolina 28403 (e-mail: galizio@uncw.edu).

status of previous examples of higher order operants (see also Pilgrim & Galizio, 2000). In particular, I raised the question of whether the well-known principles of operant behavior based on more "concrete" operants can be assumed to extend to relational frames. My use of the term *concrete* was meant to distinguish relational frames from more commonly studied and more easily measured forms of operant behavior (i.e., key peck, lever press) and was probably an unfortunate word choice because it suggested to Barnes-Holmes and Hayes the "unwarranted emergence of implicit nonfunctional or structuralistic thinking within the behavior-analytic tradition" (p. 306). Actually, my main concern is that relational frames have not been well studied as yet, and thus caution seems warranted.

To clarify, there are inherent difficulties in the measurement of relational frames, and fairly complex procedures are generally required to identify them. The methodology associated with the study of stimulus equivalence (frames of coordination) is the best developed example. Interrelated sets of conditional discriminations are trained directly, but performances on the trained relations are not sufficient to define the frame. Rather a set of carefully designed probe trials—usually conducted under extinction conditions—are necessary to identify the emergence of derived relations, and these provide the metric for the occurrence of the framing response. RFT researchers have pioneered the development of special techniques for the assessment of frames other than equivalence (e.g., opposition), and research using these techniques promises to extend the field in important ways. Because of the complexity of frame definition, it is difficult to assess many of the variables that are traditionally measured in operant analyses (e.g., response strength, rate), and, thus, direct comparison with the literature generated by more conventional operant techniques is difficult. As a result, despite the ingenious

efforts of RFT and other stimulus-relations researchers, our understanding of relational frames remains limited.

My concerns then are not that relational frames are purely functional, but rather that they have not been well characterized in terms of the particular antecedents and consequences required for establishment, maintenance, and extinction. Much of the explanatory value of an operant account is that a great deal is known about the principles of operant behavior that can be assumed to be applicable to the case under consideration. As an illustration, characterizing a behavior as an operant suggests that we know the conditions necessary to establish it (i.e., differential reinforcement). In contrast, the conditions necessary for the initial establishment of a relational frame are unknown. To my knowledge, no experimental demonstrations of the acquisition of frames of coordination, opposition, distinction, or indeed any other relational frame have yet been accomplished in humans (although Kastak, Schusterman, & Kastak, 2001, may be viewed as illustrating frame acquisition in sea lions). Of course, there are many studies of stimulus relations that have provided demonstrations of such frames in novel contexts, but in such cases the origins of the frames are obviously part of the preexperimental history of the subject. There are also studies in which the usual experimental preparations fail to demonstrate frames of coordination (e.g., many nonhuman subjects, some nonverbal human subjects), but the determinants of these failures remain to be specified. Support for the operant basis of relational frames is thus based on studies of previously established frames of unknown provenance. My position is not that the explanatory value of relational frames is limited because frames are functionally defined, but rather that it is not clear how heavy an explanatory burden frames can carry until these empirical gaps are filled in.

This point should not be taken to discount the value of the studies that

have been generated by RFT. For example, demonstrations of antecedent stimulus control and consequential control of relational frames (e.g., Healy, Barnes-Holmes, & Smeets, 2000; Wilson & Hayes, 1996) support the view of relational frames as operants and represent important steps in the development of the RFT account. Empirical analyses of the acquisition of relational frames are much needed but will be difficult to accomplish because these operants appear to be learned very early in life (Barnes-Holmes & Hayes, 2003, note that RFT holds that some relational responding may be unlearned, and this possibility seems to further emphasize the need for better understanding of the origins of relational frames). Research with infants or preverbal children is surely called for, but the lack of available data at present should not be seen as a criticism of the RFT approach. On the contrary, RFT is largely responsible for generating the renewed interest in the study of higher order operants, and despite the difficulty of the needed research, it is hoped that interchanges like the present one will help to stimulate its development.

Transformation of function: Where does it come from? Transformation of function plays a central role in RFT, and Hayes, Fox, et al. (2001) define it as follows: "When a given stimulus in a relational network has certain psychological functions, the functions of other events in that network may be modified in accordance with the underlying derived relation" (p. 31). Although transformation of stimulus function is part of the definition of a relational frame, the initial development of the phenomena is not laid out very clearly, perhaps because the origins of mutual and combinatorial entailment are discussed in more depth and entailments are considered to be examples of transformation of function (Barnes, 1994; Hayes, 1992; Hayes, Barnes-Holmes, & Roche, 2001). Thus, the analysis of transformation in my review was based on the assumption that

the histories that give rise to mutual and combinatorial entailment are also required for other transformations of function.

To further develop the example of the origin of transformation (transfer in a frame of coordination) of function presented in the review, consider the following illustration. Suppose a child has learned a frame of coordination that includes the spoken word "cat," a pet kitten, and storybook pictures of cats. A child trained to say "meow" to the storybook pictures of cats might now also produce parental reinforcement by saying "meow" in the presence of the kitten, or after hearing the word "cat." Thus, the transfer of the spoken response "meow" to all stimuli related in the frame of coordination is reinforced, and given many different exemplars in which a spoken response is reinforced in the presence of stimuli related through entailment, such transfer becomes a part of the frame (at least in the context in which transfer is reinforced). After such a history, if the child has learned a frame of coordination involving the family car, a picture of an automobile, and the spoken word "car," and is then trained to say "beep-beep" to the picture of the car, the vocal response trained under the discriminative control of the picture would be expected to transfer to other elements in the frame (e.g., the word "car"). That language can produce instances of novel and adaptive behavior patterns of this sort is why accounts of transformation of function are so critical. If I understand the RFT account correctly, transfer occurs in the presence of the word "car" because it has come to be included in a frame of coordination with the discriminative stimulus car picture, and because such transfer has been reinforced in multiple past exemplars. Transformations can come under contextual control, and presumably this would be due to a history of nonreinforcement of transfer for particular kinds of responses in a given context. For example, transfer of responses that involve handling or tast-

ing objects presumably undergoes extinction in the presence of pictures of the objects while transfer of naming responses from object to picture might continue to be reinforced. How extensive or broad the multiple-exemplar training must be to produce generalized transfer is unknown. In the above example, if all of the instances of multiple-exemplar training involved vocal responses, would nonvocal response functions transfer? If all instances involved positive reinforcement, would avoidance functions transfer? Although many questions are apparent, note that both the initial generalized transfer of function and the contextual control of transfer appear to involve basic operant processes.

Different sorts of histories (but the same processes) must be posited to account for transformation of function across different relational frames. For example, consider what might be required in the initial formation of a frame of opposition. The subject must learn a separate set of responses to stimuli and their antonyms, and multiple-exemplar training must ultimately select those responses that differ along the continuum that is relevant to the opposition for the development of entailments and transformations unique to opposition. But again, presumably a history of multiple-exemplar training in which transferring or transforming functions in particular ways is reinforced would ultimately shape the sorts of transformations of function seen with frames of opposition and others. It will be important to flesh out the prerequisite histories in more detail for each of the frames considered by RFT (e.g., distinction, comparison, hierarchical relations) to properly evaluate the account, but in the examples of transformation of discriminative control given above, the account seems plausible.

However, one problem noted in my earlier review was how RFT can account for the origins of transformation of respondent function. Again, relational frames are operants and are de-

veloped through a history of differential reinforcement. Thus, the question I raised was how respondent functions, presumably not controlled by differential reinforcement, could come to participate in a frame. So, for example, if a child salivates in the presence of a chocolate cake through respondent conditioning, reinforcement of salivation in the presence of a picture of a cake or the word "cake" cannot be invoked to establish the transfer of the respondent to those stimuli. Although transformation of function is spoken of as involving a new behavioral principle (Hayes, 1992; Hayes, Barnes-Holmes, & Roche, 2001), no basis is provided to claim that the reinforcement of transfer of discriminative functions of operant behavior would result in the inclusion of respondent functions in the operant frame.

Barnes-Holmes and Hayes (2003) reply that RFT *does* account for transformation of respondent functions, but I found their response to leave many questions unanswered. They initially note that the respondent–operant distinction is not without ambiguity, and there is no argument on this point. However, they make it clear that RFT means to provide an account of respondent functions even when the respondent–operant distinction is taken at the level of two independent processes. They argue that once a frame has been established,

Additional stimulus functions that were not involved in that relational response may now, in appropriate contexts (what RFT refers to a C_{func} control), be transformed in accordance with the established entailment processes. . . . Although there may be differences in ease of establishment, magnitude of response, or degree of contextual control, the source or nature of the functions that are transformed is not important to the existence of the contextually controlled transformation of the stimulus function process. Functions could be unlearned, perceptual, operant, respondent, visual, gustatory, emotive, discriminative, reinforcing, and so on. The contextually controlled transformation of respondent functions thus does not require that those functions become members of operant classes during multiple-exemplar training, as Galizio suggests. (pp. 308–309)

This response does make it clear that RFT maintains that respondent (and virtually any other stimulus function) can be transformed, but does not provide or clarify the process through which the various possible transformations could be developed in operant frames. To be sure, the reason that this issue is so important is precisely because verbal behavior does appear to produce all the sorts of transformations of function that Barnes-Holmes and Hayes describe. The before–after example that they use to illustrate the transformation of respondent behavior provides another fascinating example of the power of the effects. But there is no argument about the existence of these phenomena. The question is whether RFT provides anything more than a description of them. What seems open to question are the processes through which transformation of function develops, and specifically whether reinforced multiple-exemplar training can explain their origins. If the behavior of entailment is operant behavior that originates through reinforced multiple-exemplar training, and if entailments are examples of transformations of function, then it seems that transformations of function are relational operants that originate through reinforced multiple-exemplar training. If they are, then it is not clear how respondent functions can be transformed. If they are not, then it seems that some additional process is being invoked that has not been very clearly defined. In the review, I was concerned that RFT did not account for the transformation of respondent functions. Alternatively, it may be that I simply fail to understand their account of the transformation of any functions. I apologize if this is the case, but in my defense I must point out that other reviewers have also noted a lack of clarity in the RFT position on transformation of function (e.g., McIlvane, 2003; Tonneau, 2001b). In short, the present response is a call for a more detailed explication of the processes that are proposed to explain the origins of transformation of function. It

seems critical for RFT theorists to spell out their position and its predictions more clearly.

Hayes, Blackledge, and Barnes-Holmes (2001) assert that “The analysis of human language remains a mountain that behavioral psychology has yet to climb” (p. 19). In my view, a major obstacle on the road up that mountain is the problem of transformation of function. Lest the earlier discussion be seen as singling out RFT for criticism, let me hasten to point out that other theoretical approaches to stimulus relations have tended to neglect the problem (see Tonneau, 2001a, for a critique), and that much of the recent debate and research on this important topic has, in fact, been generated by RFT. Clear specification of how transformation of function is to be explained by the various theoretical camps should lead to more definitive research and move the field closer to the summit of the language problem.

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