Mechanisms of Functional Equivalence: A Comment on Tonneau (2001)

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If I understand him right, Tonneau is saying that the issue of equivalence, properly defined, is of central importance for psychologists, but that those who have followed Sidman in his insistence on the mathematical definition of the notion have been led down the garden path. What really matters, rather, is the phenomenon of functional equivalence and the task of the experimenter is this area is to lay bare the mechanisms that are responsible for this phenomenon. This accords so well with my own views that I find it difficult to offer a truly critical commentary. What follows is no more than a few comments intended to add support to this position and to consider how the analysis might be carried forward.

Whatever the mathematician or logician may want to say, everyday usage supplies us with a perfectly good definition of the notion of equivalence -- two events may be said to be equivalent in some respect if one can act as a substitute for the other in that respect. The classic instance of such equivalence is primary stimulus generalization -- the case in which a stimulus that has not received training can act as a substitute for one that has, when it comes to evoking a conditioned response. The explanation for this phenomenon is not far to seek. Primary stimulus generalization occurs because the two stimuli hold features or elements in common; the supposedly untrained stimulus is thus able to evoke the response because some of its features were in fact directly conditioned during training with the other stimulus. Theoretically more interesting is the case in which, as a result of certain forms of prior training, generalization can be established between events that appear to hold little or nothing in common. Although the first systematic account of this phenomenon is probably that offered by Hull (1939), it was brought to the attention of a wider audience by Miller and Dollard (1941) in their classic discussion of what they called "acquired equivalence of cues". The example they cited by way illustration may seem rather melodramatic -- they postulated a case in which a pattern of aggressive behaviour acquired in interaction with one person generalizes to another, quite different, person, by virtue of the fact the the verbal label "enemy" has been attached to both -- but the implication that the study of equivalence can inform us about the way in which symbols might function will strike a chord with those familiar only with a later, and less flamboyant, literature. It also serves to justify the assertion that the study of (functional) equivalence should be a matter of central importance for psychology.

Miller and Dollard (1941) went on to discuss the mechanism by which such equivalence might be established. Their account was derived from Hull's (1939) discussion of what he referred to as secondary generalization, and was couched in the S-R terminology then current. In more modern terminology, the essence of the argument was that two quite different stimuli, call them A and B, can be rendered equivalent (that is, generalization will occur between them) by previous training in which both have become linked with a common associate, C (see Honey & Hall, 1989). The associatively activated representation of C is assumed to function to produce secondary generalization in the same way as an intrinsic common element functions to produce primary generalization between similar stimuli. That is, the representation of C will be activated (associatively) when A receives further training and will also be activated on a generalization test with B. Responses acquired by the C representation during training with A will thus be evoked on the test with B. Tonneau acknowledges the viability of this mechanism (e.g., p. 17) but his brief treatment does not establish, what I suspect may be the case, that the process postulated here may have general applicability and a capacity to explain a wider range of equivalence phenomena.

Consider the original study reported by Sidman (1971) and subsequently described by him (Sidman, 1990) as being the "basic experiment" demonstrating equivalence relations. The subject is trained on two conditional discriminations in which A signals both that B1 should be chosen rather than B2, and also that C1 should be chosen rather than C2. (A might be the spoken word "dog", B1 a picture of a dog, and C1 the written word DOG.) After such training, subjects presented with, for example, B1 show a tendency to choose C1 over C2; that is, although this has not been explicitly trained, the picture will control selection of the appropriate written word. The secondary generalization process explains this result as follows. Training on the initial discriminations will establish associations that allow the presentation of A to activate the representations of both B1 and C1. Thus B1 will be activated on those trials on which A is gaining control over the choice of C1. The B1 representation will thus also undergo this form of training with the result that when B1 is actually presented as a "sample" cue in the final test, it will be able to evoke the appropriate choice (of C1). It remains to establish that this mechanism is, in fact, actually responsible for the performance seen on tasks of this sort. Equally it remains to establish that a mechanism of this sort can be successfully applied to other equivalence phenomena that possess (as the example cited does not) all three of Sidman's defining features -- reflexivity, symmetry, and transitivity. (See Hall, 1996, for a discussion of the complications involved in this.) None the less, perhaps enough has been said to justify the proposition that associatively mediated generalization may lie at the heart of a range of equivalence effects.

The task for the experimenter now, or so it seems to me, is to investigate the validity of the mechanism that has been proposed for mediated generalization (and in saying this I endorse the general position adopted by Tonneau). Central to the proposed explanation is the notion that the associatively activated representation can be learned about; in particular that presenting a reinforcer along with a given cue will establish excitatory associations not only to the cue actually presented but also to associates of that cue. Evidence in favour of this proposal comes from the experiments by Holland (e.g., 1990) that Tonneau cites; and for my own part I have attempted to demonstrate that the effects discovered by Holland operate within the acquired equivalence paradigm itself (see, e.g., Ward-Robinson & Hall, 1999). It should be acknowledged, however, that other experimenters, using different procedures. have produced quite contrary findings. Specifically, studies of the phenomenon known as "retrospective revaluation" seem to suggest that, far from establishing an excitatory link, reinforcement of a cue will cause a reduction in any strength controlled by that cue's associate (e.g., Dickinson & Burke, 1996). Why it should be that some experiments produce excitatory learning when others, using formally similar designs, produce inhibition is currently a matter for much debate. The resolution of this issue would, I am sure, be an important step on the way to a comprehensive account of the conditions in which equivalence effects occur or fail to occur.

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