Learning and Motivation 63 (2018) 150–161

Contents lists available at ScienceDirect

Learning and Motivation

journal homepage: www.elsevier.com/locate/l&m

Effect of the number of between-classes reject baseline relations on equivalence class formation

Elberto A. Plazas*, Carlos-Wilcen Villamil

Fundación Universitaria Konrad Lorenz, Bogotá, Colombia

ARTICLE INFO

Keywords:
Stimulus equivalence
Matching to sample
Conditional discrimination
Sorting behavior
Reject control

ABSTRACT

In this study, different training conditions involving six combinations of standard (STA) and altered (ALT) baseline trials were compared in regard to the probability of emergence of three 3-member stimulus classes. The STA and ALT baseline trials established the same within-class select relations, but the STA baseline trials established between-classes reject relations as well, while the ALT trials did not. The number of STA trials included in the baseline was related to higher likelihood of equivalence class formation; this relation, however, was not linear and simple, and rather it depended on the distribution of the STA trials, according with two dimensions in baseline training structure: the number of orthogonal relations (AB, AC) and the stimulus classes involved (Class 1, Class 2, and Class 3). A high probability of equivalence class formation was observed when between-classes reject relations were included in at least two stimulus classes, and in one of these for both orthogonal relations. It is concluded that for a six trials baseline between-classes reject relations must be involved in at least the two orthogonal relations and two classes, with a link between these dimensions, for a high probability of equivalence class formation to be ensured. Results are discussed in terms of an account emphasizing the role of sorting behavior on equivalence relations formation.

1. Introduction

Stimulus equivalence is one of the most important experimental paradigms employed in the experimental analysis of behavior for the study of symbolic processes associated to human behavior (e.g., Barnes-Holmes et al., 2005; Galizio et al., 2001; Galizio, Stewart, & Pilgrim, 2004; Stewart, Barnes-Holmes, Roche, & Smeets, 2002). This paradigm is characterized by the establishment of a baseline of conditional relations among formally dissimilar stimuli, followed by testing for the emergence of novel conditional responding according with the properties of reflexivity, symmetry, and transitivity (Saunders & Green, 1998; Sidman & Tailby, 1982). For example, if a participant is trained to select stimulus B1 conditional to stimulus A1, and to select stimulus C1 conditional to stimulus A1, it can then be expected that this participant will (a) select each stimulus conditional to itself (reflexivity), (b) select A1 conditional to B1 or C1, hence reversing the baseline relations (symmetry), and (c) will relate B1 and C1 conditionally between them (transitivity). In such case, it is said that stimuli A1, B1, and C1 are members of the same stimulus class. It has been demonstrated that transfer of stimulus functions occurs among stimuli belonging to the same stimulus class (e.g., Munnelly, Martin, Dack, Zedginidze, & McHugh, 2014; Perez, Fidalgo, Kovac, & Nico, 2015; Silveira et al., 2016).

The arbitrary matching-to-sample (MTS) procedure is one of the most commonly used procedures to teach the required conditional baseline relations, and to further test for emergent (i.e., untrained) responding (Arntzen, 2012; Saunders & Green, 1998). In

* Corresponding author at: Department of Psychology, Fundación Universitaria Konrad Lorenz, Cra. 9a Bis. 62-43, Bogotá, Colombia.
E-mail address: elbertoa.plazasp@konradlorenz.edu.co (E.A. Plazas).

https://doi.org/10.1016/j.lmot.2018.06.002
Received 5 December 2017; Received in revised form 28 June 2018; Accepted 30 June 2018

this procedure, the selection of one out of two or more comparison stimuli is reinforced conditionally to the presence of a particular sample stimulus. Traditionally, it is said that between each sample stimulus and the correct comparison stimuli (i.e., the selection of which is reinforced in the presence of the sample) a 'Select,' 'sample-S+,' or 'positive' relation, is established. In a similar way, between each sample stimulus and the incorrect comparison stimuli (i.e., the selection is which is *not* reinforced in the presence of the sample) a 'Reject,' 'sample-S–', or 'negative' relation, is established (Carrigan & Sidman, 1992; Johnson & Sidman, 1993; McIlvane, 2013). Although the MTS procedure typically establishes both sample-S + and sample-S– relations (e.g., Stromer & Osborne, 1982), correct responding in MTS trials may be controlled either only by the sample-S + or by the sample-S– relations (Carrigan & Sidman, 1992; Dube & McIlane, 1996), and tests are required to clarify the controlling relations for each particular case (de Rose, 1996). Most stimulus equivalence studies have employed the standard MTS procedure for the establishment of the required conditional baseline relations among stimuli. This procedure establishes within-class Select conditional relations, and between-classes Reject conditional relations. So, in a typical three-comparisons training trial with this procedure, such as A1-B1/B2, B3 (corresponding to sample-S +/S–, S–, respectively), a Select relation between stimuli A1 and B1 is established, and both come to belong to the same stimulus class. Concurrently, two Reject relations are established in such a trial, one between A1 and B2, and the other between A1 and B3. Moreover, in other training trials B2 will be the S + to sample A2, and B3 will be the S + to sample A3, so that B2 and B3 come to belong to different classes than A1. It has been demonstrated that the baseline trials of the standard MTS procedure yield high S + and S– control (e.g., Dixon & Dixon, 1978; McIlvane, Withstandley, & Stoddard, 1984; Stromer & Osborne, 1982). Furthermore, participants trained with this procedure show a high probability of emergence of equivalence relations (e.g., Clayton & Hayes, 2004; Smeets, Barnes-Holmes, & Cullinan, 2000), and the formation of equivalence classes is related to high S+ (Select) and S– (Reject) baseline control (Arantes & de Rose, 2015; Carr, Wilkinson, Blackman, & McIlvane, 2000; de Rose, Hidalgo, & Vasconcellos, 2013; Grisante & de Rose, 2014; Kato, de Rose, & Faleiros, 2008; Tomonaga, 1993).

In a recent study, Plazas and Peña (2016) compared the standard MTS procedure with a variation of it that they called 'altered MTS' procedure, in which within-class Select relations are trained, but between-classes Reject relations are not, by including as comparisons stimuli that are not positively related to any sample stimulus. A typical training trial with the altered MTS procedure is A1-B1/X1, X2, in which the selection of B1 in the presence of sample stimulus A1 is reinforced, while the selection of X1 or X2 is not reinforced. Unlike the standard MTS procedure, stimuli X1 and X2 are not the S + for any sample stimulus across training trials. Thus, despite both procedures training the same Select relations, Plazas and Peña found that they strongly differed in their probability of establishing equivalence relations. While 11 out of the 15 participants (73.3%) who were trained with the standard MTS procedure obtained high scores on symmetry and equivalence test trials, only 2 out of 25 (8%) participants who were trained with the altered MTS procedure obtained similar results. This difference on the probability of equivalence class formation between the standard and the altered procedures has been also found to persist regardless of which basic MTS training structure is used: one-to-many, many-to-one, or lineal series (Plazas & Villamil, 2016a, 2016b).

If the stimulus equivalence paradigm can to some extent account for human symbolic behavior occurring in natural settings, it should be expected that the way people learn some of those relations out of which some emergent responses occur in everyday contexts would be reflected in this paradigm. It is, however, difficult to find comparable instances in everyday contexts that are as well structured as in the standard MTS procedure, in which both within-class Select relations and between-classes Reject relations are exclusively trained. It is plausible, then, that in natural settings the establishment of relations among stimuli is more similar to the way they are trained in the altered MTS procedure, in which no explicit between-class Reject relations are established. It is still possible, too, that mixed scenarios —in which some relations are trained more like those with the standard MTS procedure, and others more like those with the altered MTS procedure— would be common in natural settings. In this study we address this possibility by comparing six possible combinations of standard (STA) and altered (ALT) matching-to-sample baseline trials in regard to the likelihood of formation of three 3-member stimulus classes, in an attempt to determine whether the inclusion of more altered-baseline MTS trials during training would decrease the likelihood of equivalence class formation. Furthermore, we attempted to determine the minimum number of standard MTS baseline trials required for maintaining a high probability of establishing three 3-member equivalence classes.

2. Materials and method

2.1. Participants

One hundred and six (106) first-semester students of an under graduate program in psychology participated in this study. Their ages ranged from 16 to 30 years old ($M = 19.5$, $SD = 3.0$). For their participation in this study, they received academic credit in an introductory Psychology class. Before the experimental procedure began, participants signed an informed consent form, or were made to get it signed by their parents if they were younger than 18 years old. Participants were randomly assigned to six groups, five of them with 19 participants, and one group (Group 3) with 11 participants, because it was introduced after the start of the experiment.

2.2. Setting, apparatus, and stimuli

The experiment was conducted in a psychology laboratory consisting of individual cubicles separated by modules to prevent visual contact with the performance of other participants. Each participant sat in front of a table with a polychromatic screen, a keyboard, a mouse, and a set of headphones. Participants used the keyboard to introduce identification information before the start of