Teaching the Meaning of "Different":

Establishing derived relational responding in patterns of coordination and distinction

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What does it mean to "understand" difference vs sameness?

Generalized, contextually-controlled relational responding:
Responding to cues of "same" vs "different": relational listener responses (find same/different), relational tacting (are these the same or different?), relational pair matching (same pair to same vs different). *See Ming & Stewart (2017).*

Nonarbitrary vs arbitrary relational responding:
Based on physical similarity/difference (NONarbitrary) or based on social convention (arbitrary)?

Derivation and Transformation of Function:
Untaught relational responses emerging from taught conditional discriminations; stimulus functions transforming in accordance with the relevant relation.

If A=B and B≠C, then A≠C.

If Joe likes the same music as Sue, and Sue likes different music from Jane, and Jane likes jazz, does Joe like jazz?

If the lion likes the same food as the penguin, and the lion likes different food from the sheep, and the sheep likes hamburgers, what does the penguin like?

Establishing same/different DRR

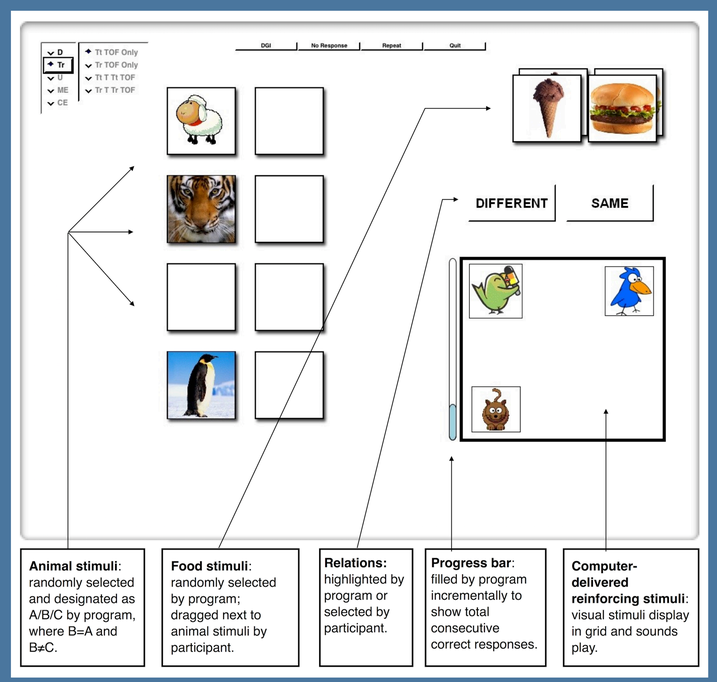
Participants:
Isaac: 12 y.o.; PPVT 7-0; dx ASD
Ann: 11 y.o.; PPVT 6-5; dx ASD
Screened and trained as necessary to ensure nonarbitrary same/different responding

Setting: Nonpublic school providing small group instruction focused on speech and language needs

Materials: *The Training and Assessment of Relational Precursors and Abilities* (TARPA; Moran, Stewart, McElwee & Ming, 2010, 2014; Moran, Walsh, Stewart, McElwee & Ming, 2015), presented on an Apple iPad ™; generalization testing used written text on a whiteboard

Design: Concurrent multiple baseline with pre and post-tests for generalization to questions about a short written "story".

The TARPA: DIFFERENT



Animal stimuli: randomly selected and designated as A/B/C by program, where B=A and B≠C.

Food stimuli: randomly selected by program; dragged next to animal stimuli by participant.

Relations: highlighted by program or selected by participant.

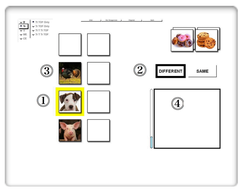
Progress bar: filled by program incrementally to show total consecutive correct responses.

Computer-delivered reinforcing stimuli: visual stimuli display in grid and sounds play.

Intervention

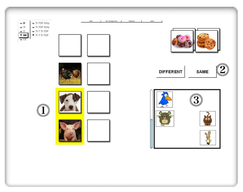
Relational Tacting followed by MET in Transformation of Function

Intervention Step One: Conditional Discrimination Training



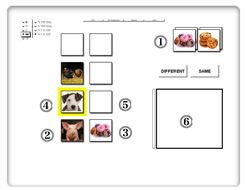
① B stimulus highlighted by program; participant touches B stimulus.
② Relational cue highlighted by program (quasi-random selection).
③ Participant touches A/C stimulus and states relation (e.g., "The dog likes different food from the turkey.").
④ Reinforcement provided for correct responses; correction and reset of progress bar for incorrect responses.
Training continues until 10 consecutive correct responses are made.

Intervention Step Two: Relational Tact Training



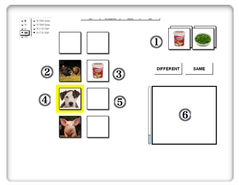
① BA/BC stimulus pair highlighted by program (quasi-random selection).
② Participant touches name of relation and states relation (e.g., "The dog and the pig like the same food.").
③ Reinforcement provided for correct responses; correction and reset of progress bar for incorrect responses.
Training continues until 6 consecutive correct responses are made.

Intervention Step Three: DRR Training



① New food stimulus set selected by program for each trial.
② A/C stimulus highlighted by program (quasi-random selection).
③ Participant selects and drags a food stimulus next to highlighted animal.
④ B stimulus highlighted by program.
⑤ Participant selects a food and drags next to B stimulus.
⑥ Trial scored as correct/incorrect; e.g., correct response given relation B (dog) = A (pig) is to drag donuts next to dog. Reinforcement provided for correct responses.

Intervention Step Four: DRR Training with Pre-task Prompting

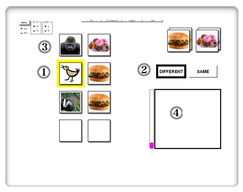


*⑥ Pre-task prompting:
a) Prompt to tact relation (e.g., "Do the dog and the turkey like same or different?" "Different").
b) Prompt to identify food relation (e.g., "Which food is different from what the turkey likes?" "Peas")

①Same food stimulus set used for first task of correction procedure, then new food stimulus set selected by program for each subsequent task.
② Same A/C stimulus highlighted by program for first task of correction procedure, then new A/C stimulus highlighted (quasi-random selection) for subsequent tasks.
③ Participant selects and drags a food stimulus next to highlighted animal.
④ B stimulus highlighted by program.
⑤ Pre-task prompting* provided by teacher, then participant selects a food and drags next to B stimulus.
⑥ Task scored as correct/incorrect; e.g., correct response given relation B (dog) ≠ C (turkey) is to drag peas next to dog. Reinforcement provided for correct responses.

Screening/pre-training

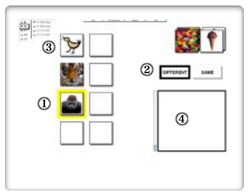
Non-arbitrary same/different game



① Stimulus highlighted by program (random selection).
② Relational cue highlighted by program (quasi-random selection).
③ Participant touches stimulus based on highlighted relation.
④ Reinforcement provided for correct responses; correction and reset of progress bar for incorrect responses.
Training continues until 10 consecutive correct responses are made.

Baseline

Step One: Conditional Discrimination Training

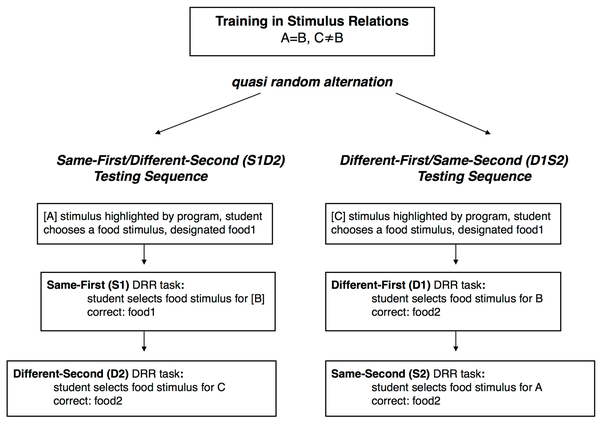


① B stimulus highlighted by program; participant touches B stimulus.
② Relation highlighted by program (quasi-random selection).
③ Participant touches A/C stimulus and states relation (e.g., "The gorilla likes different food from the bird.").
④ Reinforcement provided for correct responses; correction and reset of progress bar for incorrect responses.
Training continues until 10 consecutive correct responses are made.

Step Two: DRR Testing

①A/C stimulus highlighted by program (quasi-random selection).
② Participant selects and drags a food stimulus next to highlighted animal.
③ B stimulus highlighted by program.
④ DRR test: Participant selects a food and drags next to B stimulus.
Trial scored as correct/incorrect; no feedback provided. E.g., correct response given relation B (gorilla) ≠ C (bird) is to drag ice cream next to gorilla.

DRR Testing Sequences for Each Trial



Results

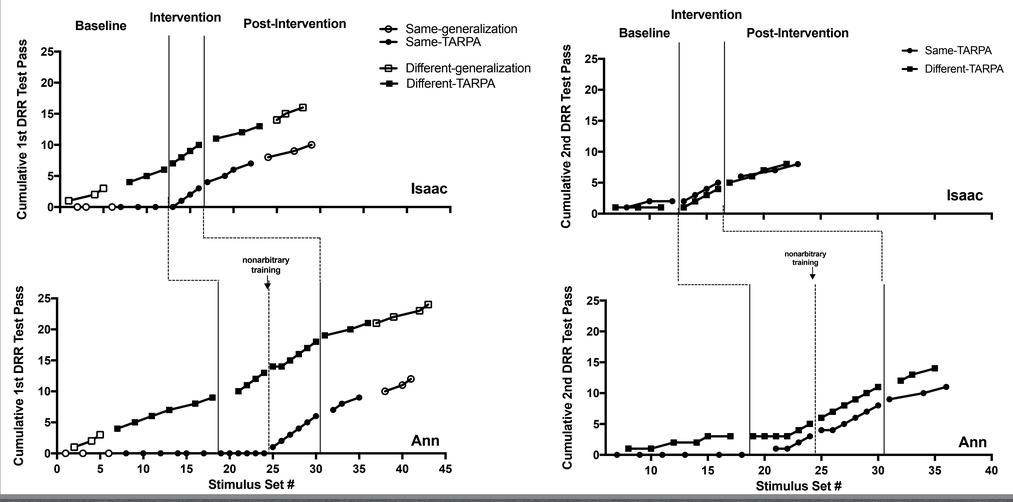
Dependent Variable: Accuracy of of responding during tests of DRR/ToF for each relation, following training in baseline conditional discriminations requiring responding to cues of SAME and DIFFERENT.

IOA: Data collected automatically; electronic data files compared to manual tracking of pass/fail test criteria for all sessions with 100% agreement. IOA collected by second observer for 25% of generalization trials, with 100% agreement

Results: Both participants demonstrated a distinctive pattern of consistently selecting the "different" food from the one initially chosen for the first animal highlighted when selecting the food for the B animal stimulus. As a result, their responding on D1 tasks was consistently scored as correct, while their responding on the S1 tasks was consistently scored as incorrect. Thus, even though their responding on D1 tasks was 100% "correct", the overarching pattern clearly indicated that responding was not under control of the contextual cues. On the second DRR task for each trial in baseline (i.e., the task that involved selecting what the third animal "liked" following selection of the food that B liked), a somewhat similar pattern of responding was seen for Ann, as she got 3/6 D2 tasks correct but 0/6 S2 tasks correct; Isaac showed no particular pattern, getting 1/3 D2 correct and 2/3 S2 tasks correct.

Both participants readily responded to relational tact trials once the intervention phase began, with very few errors on any stimulus sets. However, simply training the relational tacts appeared insufficient for correct responding on DRR tests, as both failed at least the first set of DRR tests following relational tact training.

Both participants successfully demonstrated appropriate responding in generalized patterns of same/difference relations following training, and generalized this skill to a simple test of reading comprehension. This study represents the first controlled demonstration of the effectiveness of MET for establishing a repertoire of DRR in accordance with same/difference relations in children with autism.



Discussion

Implications for rote responding
Children with autism are often described as responding "rotely"—that is, in a way that suggests that they do not truly "understand" what they are saying but are only repeating what they have been taught. One sense of the use of this description might be that they have learned a variety of conditional discriminations, but the stimuli do not participate in a variety of relational frames and do not take on new, contextually controlled, functions as a result. Prior to intervention, the children in this study were not responding in accordance with the appropriate pattern of derived relations based on the relations taught, but rather only by selecting whichever food had not yet been selected. Simply being able to state that "A likes the same as B" or that "B and C like different food" did not allow them to make any other response that was in accordance with the specified relation, even given the non-arbitrary support of the presence of the food pictures. After appearing to come under appropriate contextual control for relational responding via the intervention, however, they were then able to respond correctly to the tests of DRR. That is, they seemed to be able to demonstrate contextually controlled transformation of function, in which direct training of the preference function for one stimulus (e.g., C likes candy) resulted in transformation of the functions of others (e.g., B likes chips), in accordance with the relations involved (i.e., difference).

Implications for reading comprehension
The current work represents the first study with children with autism to train same/different relational responding and also explicitly test for generalization to an academically-relevant task: a simple test of reading comprehension. The results thus also highlight the complex relation between generative language skills and reading comprehension. Newsome et al. (2014) have noted that the ability to relate concepts in terms of sameness and distinction is critical for reading comprehension. We would agree with their conclusions that RFT provides a useful way to examine language and reading comprehension, and can provide a framework for the development of effective teaching programs addressing comprehension deficits. In the current study it was not until the pattern of derived relational responding skills were specifically trained that the participants could respond to the text-based relations in a "meaningful" way.

Need for training in nonarbitrary relations
For learners who do not yet have a robust non-arbitrary repertoire (as may have been the case for Ann in this study), this deficit is also likely to impact their arbitrary relational responding repertoire. Within the framework of combined same/different relations, it may be beneficial to strengthen the repertoire not only through generalization training with other contexts, but also through training that focuses on flexibility of non-arbitrary responding (i.e. by establishing additional contextual control), such as where different animals live (e.g. farm or forest or desert), whether they have fur or feathers, how many legs they have, and so on. At the non-arbitrary level, such training should be relatively straightforward, has the potential to increase flexibility of responding more generally, and may have the potential to lead to more rapid acquisition of arbitrary relational responding skills as well. All these are empirical questions awaiting further study, and are critical to understanding how more advanced language repertoires such as hierarchical categorization might be most effectively taught.

Notes/References

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