MASTER THESIS
LEARNING IN COMPLEX SYSTEMS
MAY 2015

Categorization in Children with Autism

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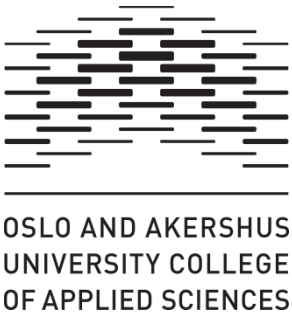

Acknowledgements

I would like to give a huge thanks to all my colleagues at Center for Early Intervention (STI) for their help and support in the construction and implementation of this study. A special thanks to Sigmund Eldevik PhD and BCBA-D, for his excellent and thorough guidance and supervision throughout the whole process. Thank you all for your patience! In addition I would like to thank the research group of Applied and Experimental Behavior Analysis in Clinical Practice at the Oslo and Akershus University College for their input and support.

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Abstract

Developing methods to teach functional language and more fluent speech in children with autism spectrum disorders (ASD) is a growing area of research. There are some findings that suggest that the ability to categorize may be an important part in this. Typically developing children begin to form categories in their first year of life, but for children with ASD, the skills are seen much later, if at all. Additionally, categorization skills in this population are usually very restricted and difficult to teach. The purpose of Article 1 is give an overview of how categorization has been conceptualized within behavior analysis, and how that knowledge has been used to develop teaching strategies and some suggestions for future research. Article 2 describes a study were three children with ASD were taught to categorize using a multiple exemplar training (MET) protocol. Two of the three children mastered new categories on first trial during the sessions and all showed maintenance of previously mastered categories over time. The results indicate that MET may be used to teach children with ASD to successfully categorize new, untaught categories on a first trial basis and to maintain the skill over time. Still, much has to be done in this area.

Keywords: autism spectrum disorder, categorization, verbal behavior, behavior analysis, generalization

The Role of Categorization in Developing a Functional Language for Children with Autism

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Categorization

As an adult, when you see an unfamiliar object, one of the first things you try to do is decide what it is and how it fits into this world. For example; you come across a strange organism at the beach. Is it a plant? Is it an animal? Often, this is not something you do consciously, except when you come across something really strange and unfamiliar. If we cannot identify it ourselves, we tend to get information from our surroundings. We ask the person next to us or perhaps we use a search engine on the internet to look it up. Quinn and Oates (2004) suggest that how we make sense of the world is due to the rich and extensive system of categories that we all have. A *category* is defined by the Oxford English Dictionary (2014) as a class or division of people or things regarded as having particular shared characteristics. *Categorization* is the process of placing people or things in a particular class or group. Typically cognitive science considers *concepts* as mental representations facilitating the categorization process, *categorization* being the process of determining what things "belong together" and a *category* a group or class of stimuli or events that so cohere (e.g., Barsalou, 1992). In contrast to the cognitive tradition where the goal often is to map the knowledge applied in established patterns of categorizations, the goal in behavior analytic tradition is to identify the functional relations between environmental events and behavior (e.g., Pierce & Cheney, 2013). This also includes verbal behavior and categorization; what is the organism doing when it is said to act conceptually and ultimately the necessary and sufficient learning histories for behaving that way (Zentall, Galizio, & Critchfield, 2002). Keller and Schoenfeld (1950, p. 154) suggested that ''…when a group of objects gets the same response, when they form a class the members of which are reacted to similarly, we speak of a concept''. Categorization may then be said to incorporate a pattern of systematic differential responding to classes of non-identical, although potentially

discriminable stimuli, and a category a class of stimuli that occasion common responses in a given context (Zentall et al., 2002).

Skinner's (1957) behavior analytic theory of verbal behavior suggests several different verbal operants (e.g. mand, tact, echoic and intraverbal). Skinner defined an intraverbal as a verbal response for which there is no formal point-to-point correspondence with the evoking verbal stimulus. Braam and Poling (1983) extended Skinner's definition of an intraverbal to include answering questions about category membership. For instance, the verbal stimulus "furniture" may evoke responses like "chair, sofa and table". Each response can be considered a member of the "furniture" category, because they are members of the same response class. Skinner's intraverbal relation also includes what others term conversational language, question answering, and reciprocal language interactions (Goldsmith, LeBlanc, & Sautter, 2007). Another way of putting it is that objects that produce the same listener and speaker behaviors are said to belong to the same class or category (e.g., Horne & Lowe, 1996; Miguel & Kobari-Wright, 2013). Again; if a child learns to say "shellfish" about a new object he or she has encountered (i.e. speaker response). He or she may then also be able to select it from an array of objects when hearing the word "shellfish" (i.e. listener response). In addition, the child might be able to put it with other shellfish when asked to do so (i.e. categorization).

There are different views within behavior analysis as how to explain concept learning and categorization a) Sidman's Theory (Sidman, 1994, 2000), b) Naming Theory (Horne & Lowe, 1996), c) Joint Control (Lowenkron, 1998, 2006) and d) Relational Frame Theory (RFT) (Barnes-Holmes, Barnes-Holmes, & Cullinan, 2000; Dymond & Roche, 2013). The most prominent accounts, in my view, seem to be Sidman's Theory and RFT, and I will give a brief description of these.

Sidman's Theory of stimulus equivalence

The logical relations of reflexivity, symmetry and transitivity are the properties that an equivalence class is derived from. Reflexivity refers to identity matching; A as sample is matched to A as comparison stimulus, B as sample is matched to B as comparison stimulus, and so on. Symmetry refers to the reversibility of a relation; if A equals B, then B equals A. Transitivity refers to the transfer of the relation to new combinations through shared membership; if A equals B and B equals C, then A equals C. Training AB and BC may produce AC, BA, CA, and CB as emergent relations. For example; given AB and BC the combination of symmetry and transitivity implies the CA relation. The emergence of all possible stimulus relations after only AB and BC are trained through contingencies is the criterion for calling the three stimuli, members of an equivalence class. Stimuli that are members of an equivalence class are likely also to be functionally equivalent (Sidman, 1994, 2000). In regard to categorization Sidman (1994) used the term partition, meaning that things are separated, e. g table, chairs, sofas etc. He explained that if partition is possible then "pairs of components within each class will be included in an equivalent relation" (p. 417). An example would be that circles, squares and triangles are partitioned (categorized) based on their shape and therefore squares are equivalent to each other, the same will hold true for circles and triangles. Sidman (1994) argues that categorization is also possible with objects that are similar but physically different. Common function is what classifies the stimuli that are physically different. For example chairs can have quite a few different physical appearances, but they have a common function; you sit on them. Categorization is related to stimulus classes that consist of functional related stimuli. The stimuli included in the class are equivalent. Sidman (1994) therefore ends his line of reasoning that equivalence relations and partition, (i.e. categorization), is the same thing.

Relational Frame Theory (RFT)

Where stimulus equivalence is an empirical phenomenon; RFT is a behavioral theory about how that phenomenon comes about. This means that RFT provides an operant analysis of why or how people are able to form equivalence classes. Originally developed by Hayes, Barnes-Holmes, and Roche (2001) RFT suggests that derived equivalence and language are essentially the same phenomenon, namely generalized contextually controlled arbitrarily applicable relational responding. They sum this up in the more simple term, relational framing. According to RFT the core defining element in diverse psychological phenomena including, for example, stimulus equivalence, naming, categorization, understanding, analogy, metaphor, and rule following, and many other inherently verbal activities, is relational framing. RFT claims that such responding is amenable to an operant analysis. As relational frames, specific types of relational responding are defined by the three properties of mutual and combinatorial entailment, and the transformation of functions. Relational frames are arbitrarily applicable, but not necessarily arbitrarily applied in the natural language context. Mutual entailment refers to the derived bidirectionality of some stimulus relations, and is a generic term for the concept of symmetry in stimulus equivalence; A is related to B in a specific context and as a result a relation between B and A is entailed in that context. Combinatorial entailment refers to instances in which two or more relations that have acquired the property of mutual entailment mutually combine. Combinatorial entailment is the generic term for both transitivity and equivalence in stimulus equivalence; A is related to B and B is related to C, and then in that context a relation is entailed between A and C and another between C and A. A typical example in the words of RFT is that if A is darker than B, and B is darker than C, then a darker-than relation is entailed between A and C, and a lighter-than relation is entailed between C and A. This also is an example of RFT taking

a step further in trying to explain emergent relations. A transformation of stimulus functions is said to occur when the functions of one stimulus alter or transform the functions of another stimulus in accordance with the derived relation between the two, without additional training. Mutual and combinatorial entailments are regulated by contextual cues. The transformation of stimulus functions are regulated by additional contextual cues (Dymond & Roche, 2013; Hayes et al., 2001).

RFT describes a learning process applicable to a variety of complex human behaviors. Verbally competent humans are able to relate events, cognitive and otherwise, without a direct conditioning history. "Relating" in this context, means to respond to one event in terms of another. Humans can respond relationally to stimuli in addition to formal stimulus properties. For example; imagine going to visit a loved one's grave. The formal properties of the grave may include the color and texture of this particular stone, but the relational properties may include talking to the grave. There is no formal relationship to the stone itself, but the response reflects a functional relationship to the stimulus functions of the grave. This has not been found in non-humans (Hayes & Long, 2013), and the behavior of talking to the grave is not properly accounted for in Sidman's Theory of stimulus equivalence.

Treating relational responding as a generalized operant, RFT appeals to a history of multiple exemplar training (MET). An example are caregivers whom often will utter the name of an object in the presence of their child and then reinforce any orienting response that occurs towards that particular object (e.g. hear name "cup", look at cup). In addition they often present the object to the child, modeling the name and reinforce an echoic responding (see cup, hear and name cup). After a sufficient number of name-to-object and object-to-name exemplars have been taught, RFT suggests that the generalized operant of symmetrical object-name responding is

established. With caregivers now informing the child of the name of a new, untaught object (e. g bottle) the child will be able to, with contextual cues as pointing, not only answer "bottle" when asked "What is it?", but also derive the response of pointing to the bottle when asked "Where is the bottle?" (Ming, Moran, & Stewart, 2014). These behaviors now constitute two sides in a generalized relational frame established through learning a sufficient number of exemplars.

There are many kinds of relational frames defined in the RFT literature. Some of the more common are coordination, opposition, distinction, comparison and hierarchical relation. Relating in terms of hierarchy is the behavior of relating one stimulus to other stimuli that "belong to it" (Hayes et al., 2001). For example the word furniture is related to the words chair, sofa and table. To categorize is therefore a hierarchical relational frame.

Development of categorization

Typically developing children show a sudden "spurt" in the growth of their vocabulary between the ages of one and two years. There are some evidence that this spurt is linked to a particular stage in the developmental of categorizing, suggesting that there is some connection between language development and categorization (e.g. Gopnik & Meltzoff, 1987; Gopnik & Meltzoff, 1992; Oakes, Cashon, Casasola, & Rakison, 2011). Quinn and Oates (2004) go through several studies using experimental techniques and states this; at first infants seem to group things together (categorize) on the basis of perceptual features of objects, color, shape, texture and so on. In other words, what things look like. Through co-occurrence of certain visible features perceptual categories might be formed. For instance the perceptual category "chair" might be formed based on the visible similarity of four legged things with a back. Then, in later periods of infancy conceptual categorization starts to develop. Infants use less obvious features in order to group things together and this process results in categories that are richer and more open to

reflection. A chair also becomes something you can sit on, use to reach high places, and so on. As the infants grow older more abstract forms of categorization are seen. Oakes et al. (2011) continue this line of thought and say that it is evident that within the first year of life, infants begin to form categories. For instance, they start categorizing female and male faces. The categories are flexible and may be open to change as a result of experience. Gastgeb, Dundas, Minshew, and Strauss (2012) suggest that categorization may reduce demands on memory in allowing individuals to focus on important aspects of objects while ignoring irrelevant details. For instance noticing if the object in question has a trunk and leaves witch would put it in the tree category rather than how tall the trunk is and how many leaves it has. If categorization helps children to learn language, it can be said to be critically important. However, for individuals with an autism spectrum disorder (ASD) categorization skills are often limited and the repertoires are usually small and restricted (Edwards, Perlman, & Reed, 2012).

Characteristics of ASD

The autism spectrum disorders (ASD) is an umbrella diagnosis which include previously separate diagnosis like autistic disorder, Asperger's disorder, childhood disintegrative disorder and pervasive development disorder not otherwise specified. ASD is a term used by the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) to label individuals with a common set of impairments; reduced interest in socializing, reduced ability in communication and to interact verbally and stereotypic behavior patterns. Rather than a simple yes/no diagnosis to a specific disorder, the ASD represents a continuum from mild to severe (American Psychiatric Association, 2014). The International Classification of Diseases (ICD-10) still use the separate diagnosis of Childhood Autism, Asperger Syndrome, Atypical Autism, other pervasive developmental disorders, Pervasive Developmental Disorder–Not Otherwise Specified (PDD-

NOS), but it is expected that they will take use of the spectrum disorder in later updates (World Health Organisation, 2014). Lovaas and Smith (1989) argued that the learning difficulties children with ASD experience can be viewed as a mismatch between a deviant nervous system and average or typical environments, but that they are able to learn as much as other human beings in certain environments.

Isaksen, Diseth, Schjølberg, and Skjeldal (2012) conducted a prevalence study in Norway which included 31 015 children, ages six to 12. They found the prevalence of ASD to be 51 per 10 000 children. A global study by Elsabbagh et al. (2012) found the prevalence to be 62 per 10 000.

Autism and Communication

Communication is a cornerstone in order to understand what others wants to convey and how the world works. From the early beginning where eye contact, crying and other sounds are important in the interaction between caregiver and the newborn baby, to conversations about the meaning of life between adults. Communication gradually evolves and picks up momentum when the child is between one and two years of age; when the child says its first words and starts to form sentences. For many, this will be the time where it is clear that some children develop differently. Children with ASD will often have slow development at this age and some will regress and loose language. Many will not start to combine words into sentences. For those who do, the language is often restricted to expressing exactly what they want and what they are trying to avoid. This is a contrast to other children who use language to get a reaction, like smiles and confirmation, from their caregivers (Hernes & Larsen, 2012). Our vocal language is quite rich and we often use many metaphors and language forms as sarcasm and irony. These language tools are often confusing and lead to misunderstanding in individuals with ASD as they often

have a literal understanding of language. The communication skills for children with ASD varies from those that do not develop a vocal speech at all, or only uses a few words, to those who develop a seemingly normal or even better speech than their peers. According to a review by Eigsti, de Marchena, Schuh, and Kelley (2011) previous estimates suggested that about 50 % of individuals with ASD never acquire functional speech. Recent advantages in diagnosis and early intervention has seen this estimate drop to about 15 % (Adamson, Romski, & Barton-Hulsey, 2014). Even so, language difficulties remain a dominant concern for individuals with ASD. Wodka, Mathy, and Kalb (2013) found that about 30 % of those with the core syndrome of autism never speak in communicative phrases (i.e., the ability to use complex utterances to talk about topics outside of the immediate physical context), and that most people with ASD have difficulties with the more abstract parts of language.

Autism and Categorization

For many individuals with ASD categorization is a hard skill to learn and the repertoires are often small and restricted. In spite of Early Intensive Behavior Intervention rote, inflexible responding is a persistent problem in children with ASD (Klintwall & Eikeseth, 2014). Very little research has been devoted to establishing categorization in individuals with ASD and in the few studies that have been done, the results are mixed. Early studies suggests that for individuals with ASD it is easier to categorize successfully when the task is rule based rather than when it is more abstract or complex. For instance to put different chairs (all things with four legs and a back) in a category is easier than distinguishing between female and male faces (e.g., Minshew, Meyer, & Goldstein, 2002). Further, while individuals with ASD are successful in categorizing on the basis of simple features, such as colors and shapes (Tager-Flusberg, 1985; Ungerer & Sigman, 1987), they may have difficulty categorizing when it is based on more complex or less perceptually

apparent features such as discriminating between dogs and cats. Both have four legs, a tale and a snout, how do we know one is a cat and one is a dog (Klinger & Dawson, 1995; Plaisted, 2000)? Rosch (1978) stated that some members of a category are more representative or more typical than others. For example a Labrador is a more typical example of a dog than Puli. Matched on age, Full scale Intelligence Quotient, Verbal Intelligence Quotient and Performance Intelligence Quotient, individuals with ASD responded more slowly on atypical exemplars, (for example penguin being a more atypical example of a bird than a robin) than the control group did (Gasteb, Strauss, & Minshew, 2006). More recent studies suggests that while individuals with ASD may be able to categorize typical exemplars, it is possible that less typical exemplars pose more of a difficulty (e.g.,Gasteb & Strauss, 2012; Gastgeb, Wilkinson, Minshew, & Strauss, 2011; Newell, Best, Gastgeb, Rump, & Strauss, 2011). In a study conducted by Bott, Brock, Brockdorff, Boucher, and Lamberts (2006) the participants with ASD required longer to learn a category structure (i.e. classify rectangles in two arbitrarily defined categories) than the control group. According to Edwards et al. (2012) individuals with ASD displayed a greater tendency to categorize according to one dimension as compared with mental-aged matched participants on easily categorized sets. There is therefore a growing amount of evidence suggesting that individuals with ASD have difficulty with some aspects of object categorization and that they form categories in a way that differ from other verbally competent individuals. If this is true, it is possible that their lacking ability to form categories early in life can have detrimental effects on social and communication skills. A person with ASD could easily get overstimulated and withdraw from others if they are not able to understand what others are communicating, or not being able to fully convey what they mean.

Teaching strategies on autism and categorization

For children with ASD to get a repertoire that is closer to other people, it is important to develop effective teaching strategies. The literature on intraverbal responding, which seems to be a key operant in categorization, lags substantially behind the literature on mands and tacts. Several early studies have demonstrated the efficacy of different transfer-of-stimulus-control procedures (tact-to-intraverbal and echoic-to-intraverbal) for establishing intraverbal categorization responses.

Skinner (1957) defined an intraverbal as a verbal response for which there is no formal point-to-point correspondence with the evoking verbal stimulus. This means that you answer questions or have conversations in which your words are controlled by other words. For instance, saying dog because someone asks you to name an animal. A tact is defined as "a verbal operant in which a response of given form is evoked by a particular object or event or property of an object or event" (pp. 81-82), which means naming or identifying objects, actions etc. For instance, saying dog because you see a dog. An echoic is defined as verbal vocal behavior under the control of, and with common sound units to, an immediate auditory stimulus. This means repeating what is heard. For instance, saying dog because someone else is saying dog. These transfer-of-stimulus-control procedures have proven to be effective across individuals with intellectual disabilities (Braam & Poling, 1983; Luciano, Barnes-Holmes, & Barnes-Holmes, 2002; Watkins, Pack-Teixeira, & Howard, 1989), autism (Goldsmith et al., 2007) and also those of typical development (Miguel, Petursdottir, & Carr, 2005; Partington & Bailey, 1993). The participants do however show limited generalization to untrained categories and limited maintenance of skills. It seems that generalization is a factor that needs to be looked at in regard to developing categorization skills.

Generalization

In the seminal review article "*An Implicit Technology of Generalization"* by Stokes and Bear in 1977 generalization was defined to be:

> …the occurrence of relevant behavior under different, nontraining conditions (i.e., across subjects, settings, people, behaviors, and/or time) without the scheduling of the same events in those conditions as had been scheduled in the training conditions. Thus, generalization may be claimed when no extratraining manipulations are needed for extratranining changes; or may be claimed when some extra manipulations are necessary, but their cost or extent is clearly less than that of the direct intervention. Generalization will not be claimed when similar events are necessary for similar effects across conditions (Stokes & Baer, 1977, p. 350)

The ability to produce sentences new sentences, and to understand sentences never before heard, might be how language generativity, or a generalized speech, can be described. Novel responding is typically viewed as a generalization process. This is vital in order to develop fully functional communication (Stewart, McElwee, & Ming, 2013). Response generalization is the process that is often cited as underlying language generativity. Mayer, Sulzer-Azaroff, and Wallace (2012) use this definition:

> The spread of effects to other classes of behavior when one class of behavior is modified by reinforcement, extinction and so on. The shift in the form or topography of a behavior. For instance, the way a particular letter is shaped or formed may vary in ways that are similar but not identical to the formation of the letter as it was originally reinforced (p. 698).

Stewart et al. (2013) argues that this definition shows weaknesses and instead proposes a Relational Frame Theory (RFT) conceptualization of derived relations. Derived relational responding is explained as

> ...generalized contextually controlled patterns of responding based on a history of multiple exemplar training (MET) in which the functions of the contextual cues controlling the patterns involved are established (p. 143).

Stewart et al. (2013) refers to several studies (e.g. Murphy & Barnes-Holmes, 2010; Murphy & Barnes-Holmes, 2009; Rehfeldt & Root, 2005) they claim illustrate the potential of work focused on derived relational responding to assess and train generative behavior in the area of language delay.

Teaching sufficient exemplars

Teaching someone to respond to a subset of a wide array of stimulus and response examples and then assessing the individuals performance on untrained examples is a general strategy originally termed *teaching sufficient examples* by Stokes and Baer (1977). The idea is that to achieve generalization one has to teach several exemplars of the same lesson (f. ex. the lesson “point to dog”,) until generalization occurs sufficiently to satisfy the problem posed. In regard to categorization an individual has to be able to identity what belongs to a category class and what does not without it being directly trained. For example; the generalization of a child’s ability to identify dogs can be assessed by asking the child to identify several different dog breeds. If the child can correctly identify untaught exemplars as a dog then no more training is necessary. If the child is making errors then more exemplars need to be taught and new untaught exemplars probed. This cycle continues until the child correctly identifies new untaught exemplars of dog breeds as dogs.

General Case Analysis

Generalized responding to untaught exemplars will not automatically be produced through teaching a person to respond correctly to multiple exemplars. Close attention must be payed to the specific exemplars during instruction to achieve an optimal degree of discrimination and generalization, not just any exemplars will do. To select teaching examples that represents the full range of stimulus situations and response requirements in the generalization setting an effective instructional design is required. General case analysis is a systematic method for doing this (Cooper, Heron, & Heward, 2014). O'Neil summed up the steps in the general case model, adapted to their potential use in establishing verbal repertoires, like this;

Step One: Defining the Instructional Universe

Step Two: Defining the Range of Relevant Stimulus and Response Variation

Step Three: Selecting Examples for Teaching and Testing

Step Four: Sequencing Teaching Examples

Step Five: Teaching the Examples

Step Six: Testing with Nontrained

Probe Examples (O'Neill, 1990, p. 117).

An important part of this model is that the generalization planning is conducted already in the preliminary phases of training. Performance is not trained to a particular criterion in a particular situation and then shifted to varying contexts; it focuses on performance across the range of desired conditions from the initial teaching sequences (O'Neill, 1990). In the words of Don Baer (1999);

Learning one aspect of anything never means that you know the rest of it. Doing something skillfully now never means that you will always do it well. Resisting one

> temptation consistently never means that you now have character, strength, and discipline. Thus, it is not the learner who is dull, learning disabled, or immature, because all learners are alike in this regard: *no one learns a generalized lesson unless a generalized lesson is taught.* (p. 1).

Studies focusing on teaching multiple exemplars

The different terms of multiple exemplar training (MET), multiple exemplar instruction (MEI), train sufficient exemplars and general case training are sometimes used interchangeably and it can be difficult separating them in the literature. The procedures vary slightly, but common to all is that generalization has an overarching focus throughout the training. The focus on generalization is seen either through alternating response form between two or more response function in a subset of exemplars (often named MEI), presenting multiple exemplars of the same response function and probing for mastery on novel exemplars after a training set (often named MET), presenting multiple exemplars of the same response function and probing for mastery on novel exemplars after each exemplar is mastered (often named train sufficient exemplars) or selecting systematically exemplars that represent the range of stimuli included in the category to witch responding is desired and then probe on novel exemplars (often named general case training). (White et al., 1998).

The different versions of teaching multiple exemplars have been successfully implemented to teach a variety of skills to children with ASD. A few examples are, increasing vocal interaction (Garcia-Albea, Reeve, Brothers, & Reeve, 2014), sharing (Marzullo-Kerth, Reeve, Reeve, & Townsend, 2011), attending to socially relevant stimuli (Persicke et al., 2013) and metaphorical reasoning (Persicke, Tarbox, Ranick, & St. Clair, 2012). In addition, Ming et al. (2014) reviews an extensive amount of studies demonstrating the establishment of derived

relational responding, and the use of existing derived relational responding skills to teach individuals with ASD and other development disabilities different relational frames such as comparison, opposition and deictic. They conclude that RFT offers clear empirical evidence, and a conceptual pathway, for identifying priorities for skills to be taught, as well as procedures for teaching these skills. Greer, Stolfi, and Pistoljevic (2007) did a comparison of MEI and single exemplar instruction (SEI) and found that the SEI participants did not acquire the target naming skill as the MEI participants did. They did that however after their received MEI. Perhaps teaching multiple exemplars is a strategy that can try to mend the generalization problem teachers have in trying to help children with ASD acquire categorization skills?

Conclusion

The development of a fully functional language for children with ASD has gotten more attention in later years. One piece of this puzzle could be categorization as this seems to be an area where people with ASD respond differently than other verbally competent people. The use of multiple exemplars as a teaching strategy is something that needs further research as it greatly focuses on generalization which, perhaps, is a key element to learning this skill.

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Establishing Categorization in Children with Autism through Teaching Multiple Exemplars

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Abstract

There is some evidence to suggest that individuals diagnosed with autism spectrum disorders (ASD) categorize information differently from other individuals. Categorization repertoires are small and restricted if at all present, and generalization and maintenance over time are limited. We examined the effects of using a multiple exemplar training (MET) protocol on answering intraverbal categorization questions in three children with ASD. Following training, two of the three children showed generalization to novel categories and all three showed good maintenance of previously mastered categories over time. The results indicate that MET shows promise as a way teach to children with ASD to categorize. Further research is necessary to validate the protocol, and the extent to which other children with ASD can benefit from the intervention.

Keywords: Autism spectrum disorder, categorization, generalization, relational frame theory, multiple exemplar training

One of the defining characteristics of autism spectrum disorders (ASD) is impairment in communication (Patel, Preedy, & Martin, 2014). A review by Eigsti et al. (2011) estimates that about 50% of individuals with ASD never acquire functional speech. However, advances in early diagnosis and early intervention has seen this number drop to about15% (Adamson et al., 2014). Still, language difficulties remain a dominant concern for individuals with ASD. Wodka et al. (2013) found that about 30% of those with the core syndrome of autism never speak in communicative phrases (i.e., the ability to use complex utterances to talk about topics outside of the immediate physical context), and for most individuals with ASD, language difficulties will be a dominant concern throughout the lifespan.

Relational Frame Theory (RFT) suggests that language is based on generalized contextually controlled arbitrarily applicable relational responding, or said simpler, relational framing (Hayes et al., 2001; Ming et al., 2014). RFT describes a learning process applicable to a variety of complex human behaviors such as stimulus equivalence, naming, rule following and categorization. In the view of RFT, verbally competent humans are able to relate events, cognitive and otherwise, without a direct conditioning history. “Relating” in this context, means to respond to one event in terms of another. Treating relational responding as a generalized operant, RFT appeals to a history of multiple exemplar training (MET). For instance caregivers whom often will utter the name of an object in the presence of their child and then reinforce any orienting response that occurs towards that particular object (e.g., hear name “teddy bear”, look at teddy bear). In addition, they often present the object to the child, modeling the name and reinforce echoic responding (see teddy bear, hear ” teddy bear”, and say “teddy bear”). After a sufficient number of name-to-object and object-to-name exemplars have been taught, RFT suggests that the generalized operant of symmetrical object-name responding is established. With caregivers now informing the child the name of a new, untaught object (e.g. doll) the child will be able to, with contextual cues as pointing, not only

answer “doll” when asked “What is it?”, but also derive the response of pointing to the doll when asked “Where is the doll?” (Ming et al., 2014). These behaviors now constitute two sides in a generalized relational frame, established through learning a sufficient number of exemplars. The ability to produce sentences never before said, and understand sentences never before heard (i.e. generative language) is critical for developing a fully functional language. If this ability does not develop, it will require ongoing intensive teaching to learn new vocabulary and concepts (Ming et al., 2014).

Categorization

Skinner’s (1957) behavior analytic theory of verbal behavior suggests several different verbal operants (e.g. mand, tact, echoic and intraverbal). Skinner defined an intraverbal as a verbal response for which there is no formal point-to-point correspondence with the evoking verbal stimulus. For instance, the verbal stimulus “flower” may evoke responses like “rose, tulip and daisy”. Each response can be considered a member of the “flower” category, because they are members of the same response class. In the RFT literature, categorization is considered a hierarchical relational frame. Relating in terms of hierarchy is the behavior of relating one stimulus to other stimuli that “belong to it” (Hayes et al., 2001). For example, the word “flower” is related to the words “rose”, “tulip” and “daisy”. The ability to categorize information is critically important as there are evidence suggesting that this skill is linked to the language “spurt” typically developing children show in their second and third year (e.g. Gopnik & Meltzoff, 1987; Gopnik & Meltzoff, 1992; Oakes et al., 2011). Gastgeb et al. (2012), also suggests that categorization may reduce demand on memory by allowing the individual to ignore irrelevant details while focusing on the important aspects of objects.

There is a growing amount of evidence showing that individuals with ASD have difficulties with categorization (e.g. Bott et al., 2006; Edwards et al., 2012; Gastgeb et al., 2011; Klinger & Dawson, 2001; Newell et al., 2011), and that the repertoires, if present,

usually are small and restricted, showing limited generalization and maintenance (Edwards et al., 2012; Goldsmith et al., 2007). If it is true that individuals with ASD have difficulty with categorization, that they form categories in a way that differ from other verbally competent individuals and show limited generalization when the skill is taught, this can contribute to the social, communication and behavioral impairment.

Teaching strategy

As categorization probably has crucial role in language and understanding of words (e.g. Oakes et al., 2011), and many children with ASD differ in the way they categorize compared to typically developing children (Gasteb & Strauss, 2012), this is a skill that needs to be addressed.

For children with ASD to get a verbal repertoire that is closer to that of typically developing children, it is important to identify effective teaching strategies. In the behavior analytic tradition all verbal operants are considered functionally independent during typical language development (Skinner, 1957). Research supports this notion suggesting that intraverbals must be targeted directly (Braam & Poling, 1983; Luciano, 1986; Miguel et al., 2005; Partington & Bailey, 1993; Twyman, 1996; Watkins et al., 1989). Not many studies have targeted intraverbals in the ASD population but Goldsmith et al. (2007) did a study using a transfer-of-stimulus-control procedure (i.e., tact to intraverbal) in order to teach intraverbals to three children with ASD. The study provided additional support for the use of behavioral teaching strategies to teach language to children with ASD, but pointed to limited generalization and maintenance. They therefore suggests that future research should focus on which treatment components that facilitates this. According to Cooper et al. (2014) generalization probes before, during and after instruction will promote generalized behavior. Generalization probes before instruction may reveal that the individual already knows the skill in question and if there is no need to teach this task to them. Generalization probes during instruction may

reveal if, and when, generalization has occurred and thus when the skill has been established. If generalization occurs one can shift to other skills, if generalization does not occur after several exemplars, a change in instructional strategy may be needed. Generalization probes after instruction has ended may reveal the extent of generalization and maintenance. It will depend on the skill taught, the influence in the individual's life and so on, how often and how long after instruction, the probes should be conducted.

Stewart et al. (2013) presents a derived relations-based approach to generative language and describe a series of recent research studies showing the potential of RFT in the area of language delay, for instance establishing complex derived manding (Murphy & Barnes-Holmes, 2010), establishing derived requesting skills (Rehfeldt & Root, 2005) and derived more-less relational mands (Murphy & Barnes-Holmes, 2009). Ming et al. (2014) review an extensive amount of studies targeting skills within several frames, such as coordination, comparison, opposition and deictic frames, in addition to studies using an existing repertoire of derived relational responding. They argue that the RFT offers clear empirical evidence both for identifying priorities for skills to teach as well as procedures for teaching such skills. They show that MET based on RFT has been used with success in promoting generalized behavior within a variety of skills for both for typically developing individuals as well as individuals with ASD and other developmental disabilities. Facilitating relational framing (Walsh, Horgan, May, Dymond, & Whelan, 2014), establishing derived comparative and transitive relations (Gorham, Barnes-Holmes, Barnes-Holmes, & Berens, 2009) and metaphorical reasoning (Persicke et al., 2012) are examples of different successful studies focusing on generalization as part of the procedure (MET) in the teaching of children with ASD. As MET has been used with success in other studies, it would be interesting to see what effect it would have on the generalization and maintenance of categorization skills, (i.e.

hierarchical relational frame) for children with ASD. The purpose of the present study was to see if MET could promote generalization of categorization in children with ASD.

Method

Participants, Settings, and Materials

Three children recruited from The Center for Early Intervention in Oslo between the ages of 4 years and 5 months and 6 years and 1 month participated in the study. All children were diagnosed with an autism spectrum disorder and standardized assessments placed them within the normal range of intellectual and adaptive functioning. Intellectual functioning was assessed using either the Stanford-Binet (fourth or fifth edition; *Stanford-Binet Intelligence Scale Fourth and fifth addition; SB:FE; SBV)* (Roid & Barram, 2004; Thorndike, Hagen, & Sattler, 1986) and adaptive behavior was assessed using the *Vineland Adaptive Behavior Scales, Second edition (VABS II)* (Sparrow, Cicchetti, & Bella, 2005) (see Table 1 for more details). Even though the children had an age appropriate vocabulary, they were having difficulties naming objects belonging to different categories. Their categorization skills were therefore deemed to be well behind that of their typical peers.

All the children received Early Behavioral Intervention through STI. They had been in an EIBI program between 6 and 30 months- They received between 15 and 22 hours a week of intervention.

All sessions were conducted in the participant's preschools, in the separate rooms where they usually received most of their services. Sessions were 5-15 minutes long and were conducted 1-2 times a day, 3-5 days a week dependent on therapist and child availability. The teaching materials consisted of relevant category scenes printed in color on paper and laminated approximately 160 mm by 110 mm (see Figure 6 for an example). Praise and preferred toys were made available to the participants, contingent on compliance and correct responding.

Design

A non-concurrent multiple probe design across the three participants was employed in order to assess the effects of training. A baseline session consisted of four category questions. Baseline sessions were repeated two times for participant one, and three times for participant 2 and 3. The first participant, Tim, had a three-day baseline period. The second participant, Peter, had a one-week baseline period, and the third participant, Sarah, had a two-week baseline period. Baseline periods were randomly assigned to each participant before the study started. The post-test took place immediately after training was completed and a follow-up measure was conducted a month later for Peter and Sarah, and after 2 years for Tim. The baseline, post-test and follow-up questions were the same for all three children.

Dependent Variables and Data Collection

Ten categories were randomly assigned to training and four categories were randomly assigned for the tests done in baseline, post-test and follow-up. The categories that were assigned to the training conditions were; living room, ocean, bedroom, forest, grocery store, wardrobe in preschool, bathroom, jungle, kitchen drawer, face and the sky. The categories that were assigned to the test conditions were kitchen, farm, closet and preschool playroom.

Data on two dependent variables were collected during test sessions. The first dependent variable was the number of items the child could name that belonged to a given category. The second dependent variable was the number of incorrect and repeated responses. The number of correct responses during training was recorded. Naming four or less items to a given category was considered non-mastery, whilst naming five or items was considered mastery. The participant's exact answers during baseline, training and post-test were written down.

Procedural integrity and inter-observer agreement

All the steps in the procedure were written down and the teacher recorded each step as it was performed. In addition, a supervisor from STI attended all training sessions on two of the children (Peter and Sarah) and 50 % on one child (Tim) to ensure that the training protocol was implemented correctly.

Inter-observer agreement was calculated for the participant's answers in baseline and post-test. Two observers rated the answers by giving one point for a correct answer and one negative point for an incorrect answer. The inter-observer agreement was calculated using a Spearman's Rho Calculator (Wessa, 2015), as we used a rating based on the sum of positive and negative points. Spearman's Rho is a non-parametric test used to measure the strength of association between two variables, in this case two observers, where the value $r = 1$ means a perfect positive correlation and the value $r = -1$ means a perfect negative correlation. For Tim, the two observers had a 0.90 agreement on the correct responses and 0.74 on the incorrect responses. For Peter, the observers had a 0.96 agreement on the correct responses and a 0.50 agreement on the incorrect. The observers had 0.98 agreement on the correct responses for Sarah and 0.78 on the incorrect responses. Over all the observers had a high level of agreement for the correct responses, but a lower level of agreement for the incorrect responses. The average consensus across all three participants were 0.94 on the correct responses and 0.67 on the incorrect responses.

Procedure

Entry criteria. Before enrollment in the study we tested whether the children knew the name of the 14 categories included in baseline and training, and how many items they were able to name from each of the categories. As the main purpose of the study was to name objects within a category, the child had to know all the names of all the 14 categories included in the study. This was tested by placing random fields of five categories on a table and asking

the child to point to a category (e.g. “Point to living room”). If the child failed to do so on any of the 14 categories the child was excluded from the study. Subsequently the child was asked to name items from each of the categories. If the child could name five or more items within the 10 training categories, he or she was excluded from the study. In other words, the children that could point to the target categories, but not name five objects within the training categories were included in the study. The included children then started the baseline phase consisting of the remaining four categories.

Multiple exemplar training (MET). Following the baseline sessions, intervention was introduced. Each category selected for the training was probed. If the child could name five or more items within the category it was considered mastered and the next category was probed. If the child mastered three out of four consecutive categories on the first trial, categorization was considered mastered and the post-test was conducted (see flowchart; figure 1). If the child could not name five or more items within a category, training was introduced for that category. Training consisted of showing the child a picture of the category scene and then asking the child to tact items on the picture**.** When the child could tact five or more items on the picture it was removed and the child was again asked to name items within the category.…”. If the child now could name five or more items that category was considered mastered and the next category was probed. If the child could not name five or more items, the picture was shown again and training continued in the same manner as before. The child had to name five or more items from the category *without* the picture present to master the category. Following this, each mastered category was done in a random mix with previously mastered categories (see figure 1). The criteria for mastery in this phase was the same as in the previous phase (naming a minimum of five items within each category without picture present).

Results

Baseline, post-test and follow-up

Correct and incorrect responses during baseline and post-test for each child are shown in Figure 2. The number of responses to the four category questions in each session are merged into one data point in order to make the graph readable. All three children varied greatly in their responding during the baseline period. Tim had 0 correct and 4 incorrect responses during the first probe session, and 14 correct and 5 incorrect in the second. Peter had an upward trend in baseline going from 11 correct and 3 incorrect responses in the first probe session, 13 correct responses and 1 incorrect response in the second and finally 21 correct and 2 incorrect in the third probe session. Sarah had 28 correct responses and 12 incorrect responses in the first session, 4 correct and 9 incorrect responses in the second, and 32 correct and 10 incorrect responses in the third probe session.

During post-test and follow up, Tim had 19 correct and 0 incorrect responses in the post-test and 32 correct and 3 incorrect in the follow up. Peter had 19 correct and 1 incorrect on the post-test, and 40 correct and 0 incorrect responses in the follow up. Sarah had 36 correct and 0 incorrect on the post-test, 39 correct and 1 incorrect on the follow up.

Intervention

The trial-by-trial training data for each child are depicted in Figure 3, 4 and 5. The categories for Tim consisted of ocean, bedroom, living room, jungle, bathroom, forest, wardrobe, grocery store, face and sky. In the training sessions Tim (Figure 3) needed to be taught the first six categories, the next two categories were then mastered on the first trial. The ninth category had to be taught, but the tenth was mastered on the first trial. All categories only needed one prompt before it was mastered. Tim did not make any errors in the mix phases and needed 59 trials to complete the program. Tim met the criteria for mastery of the program, as he mastered three out of four novel categories on the first trial.

The categories for Peter consisted of jungle, wardrobe, grocery store, bedroom bathroom, sky, living room, ocean and kitchen drawer. Peter (Figure 4) needed to be taught the first three categories, before mastering the fourth on the first trial. The next three categories had to be taught before the last three were mastered on the first trial. As with Tim all trained categories only needed one prompt before it was mastered. In addition, Peter did not make any errors in the mix with previously mastered categories. He needed 54 trials to complete the program. Peter met the criteria for mastering the categorization program, which was three out of four mastered categories on the first trial.

The categories for Sarah consisted of jungle, wardrobe, grocery store, bedroom bathroom, sky, living room, ocean and kitchen drawer. Sarah (Figure 5) had to be taught all 10 categories, but did not make any errors when mixing previously mastered categories. Although all categories had to be taught, she only needed one prompt per category to reach mastery. Sarah needed 62 trials to master all 10 categories and met the criteria for mastery of the program.

Discussion

The results of the current study suggests that it is possible to teach generalized categorization skills to children with ASD. This is seen clearly during the intervention, less so in the probes conducted before and after intervention. All children responded somewhat better following intervention. They increased the number of correct responses and decreased the number of incorrect responses. For Tim, both of these effects can be seen quite clearly, for Peter the increase in the number of correct responses is most salient, while for Sarah the decrease of incorrect responses is most apparent. Peter and Sarah, who had a follow-up about a month after training was completed, showed good maintenance by responding equally well, or even better than during the post-test. Tim had his follow-up 2 years after training was

completed, he responded much better in the follow-up. The children seem to have variable outcome of this procedure, as the outcome was beneficial for each child in a different way.

Goldsmith et al. (2007) suggested that future studies should try identifying components that facilitate generalization and maintenance of intraverbal skills in the ASD population. In this study, generalization probes were conducted before, during and after intervention. According to Cooper et al. (2014) this promotes generalized behavior. Having generalized responding as criteria in training may also facilitate transfer across settings. If the individuals with ASD can learn how to categorize at a generalized level, it can have a major impact for them. To categorize in real life, not only in a structuralized setting is closer to how typically developing children acquire their categorization skills. The most important finding in the present study is therefore likely to be the generalization observed to untrained categories. During intervention, two out of three children mastered novel categories on a first trial basis, and all three maintained the skill over time. Sarah did not master novel categories on first trial during intervention, but both Tim and Peter reached the criteria for generalized responding, which was three out of four untrained categories correct on first trial. In addition, when the children responded to mastery for a category, they all continued to do so for the duration of the intervention. None of the children ever made an error when previously mastered categories were probed in the random mix phase. This suggests that the skill is not merely rote and memorized, but a flexible, generally applicable skill. Perhaps this is one of the reasons why the children showed good maintenance in their follow-up.

For Tim and Peter to reach the criteria for generalized responding is consistent with the results from other studies using MET as a teaching strategy both for typically developing children as well as individuals with ASD and other developmental disabilities (e.g. Gorham et al., 2009; Murphy & Barnes-Holmes, 2010; Persicke et al., 2013; Persicke et al., 2012; Walsh et al., 2014; Weil, Hayes, & Capurro, 2011). This supports the applied utility of the derived

relations-based approach Stewart et al. (2013) presents with respect to the phenomenon of generative language. Using the framework of RFT, Tim and Peter established derived relational responding within the hierarchical relational frame. The conceptual pathway and procedures provided in RFT could be a significant contribution in teaching language to children with ASD. The results of the present study confirm findings from other studies suggesting that children with ASD does not always have to be taught every single category, but that they will start to generalize after having being taught a certain number of categories. Mastering novel categories on first trial and maintaining the newly taught information over time are two valuable effects. Much time and effort are spent teaching small elements of language and making sure it is not lost over time. The children in this study used approximately the same number of trials to complete the procedure. Tim needed 59, Peter 54 and Sarah 62 trial. This points to the procedure taking little time to complete while giving some valuable effects. By reducing the amount of time spent on teaching categorization, the child can move on to other important areas.

Limitations and future studies

In an effort to account for threats to validity, such as the skill would have developed regardless of the intervention, the baseline period were of different length for each child. The probes conducted in baseline revealed that all children had some level of responding, but that the responding were inconsistent. The different baseline lengths did not seem to have any implications on this result.

Although the results of the study show promise, there are some serious limitations to the study. Each probe, consisting of four different categorization questions, were asked on two occasions for Tim and three occasions for Peter and Sarah in order to form a baseline of responding. Having only two probes to form baseline for Tim and that the number of responses within each probe varied greatly for all three participants weakens the experimental

control. The baselines does not provide enough information in determining the children's skill level. In addition, although the inter-observer agreement were high for the correct responses, it was quite low for the incorrect responses. A reason for this can be that the children told small stories and elaborated their answers when asked to name items within the category. For instance, when Sarah was asked to name items belonging to the farm she sayd "Chickens, they are cute. Sheep, oh and that thing with horns. What is it called? The one that the brown cheese comes from. I don't like brown cheese." It was difficult for the observers to agree upon how many correct an incorrect answers the child had when responding like this.

As all three children have an upward trend of responding in baseline, it is difficult to claim with certainty that the MET is what produced the changes in responding. Even so, during the intervention each category was probed for mastery before it was taught and none of the children mastered novel categories from the start. The first child to master a category on first trial, Peter, did not do so until the fourth category was probed. He also then needed three more exemplars before reaching the criteria for generalized responding. This indicates that the target skill was not in his repertoire prior to teaching. The procedure therefore shows promise and can at the very least be an inspiration to further studies.

In future studies a more close attention to the specific categories used in training could be payed. In this study, four responses within a category were considered incorrect and the children therefore had some responding within each category used both in baseline as well as in training. Perhaps only using categories where the children show no responding instead of some responding can give a more clear image of MET being a potential teaching strategy for categorization skills.

Conclusion

This study used multiple exemplar training to teach generalized categorization skills in children with ASD. Although research on categorization has suggested that this is a major deficit in individuals with ASD, our results suggest that it can be targeted and successfully remedied, by teaching the child to respond to multiple exemplars while probing for generalization. Despite the limitations of the study, these results are encouraging as they suggests complex language deficits may be amenable through behavioral intervention.

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Table 1

Child Characteristics

Child	Gender	Age	Diagnosis	Intellectual functioning
Child 1	Male	6 years 1 months	Autism	Within normal range
Child 2	Male	4 years 5 months	Autism	Within normal range
Child 3	Female	5 years 6 months	Autism	Within normal range

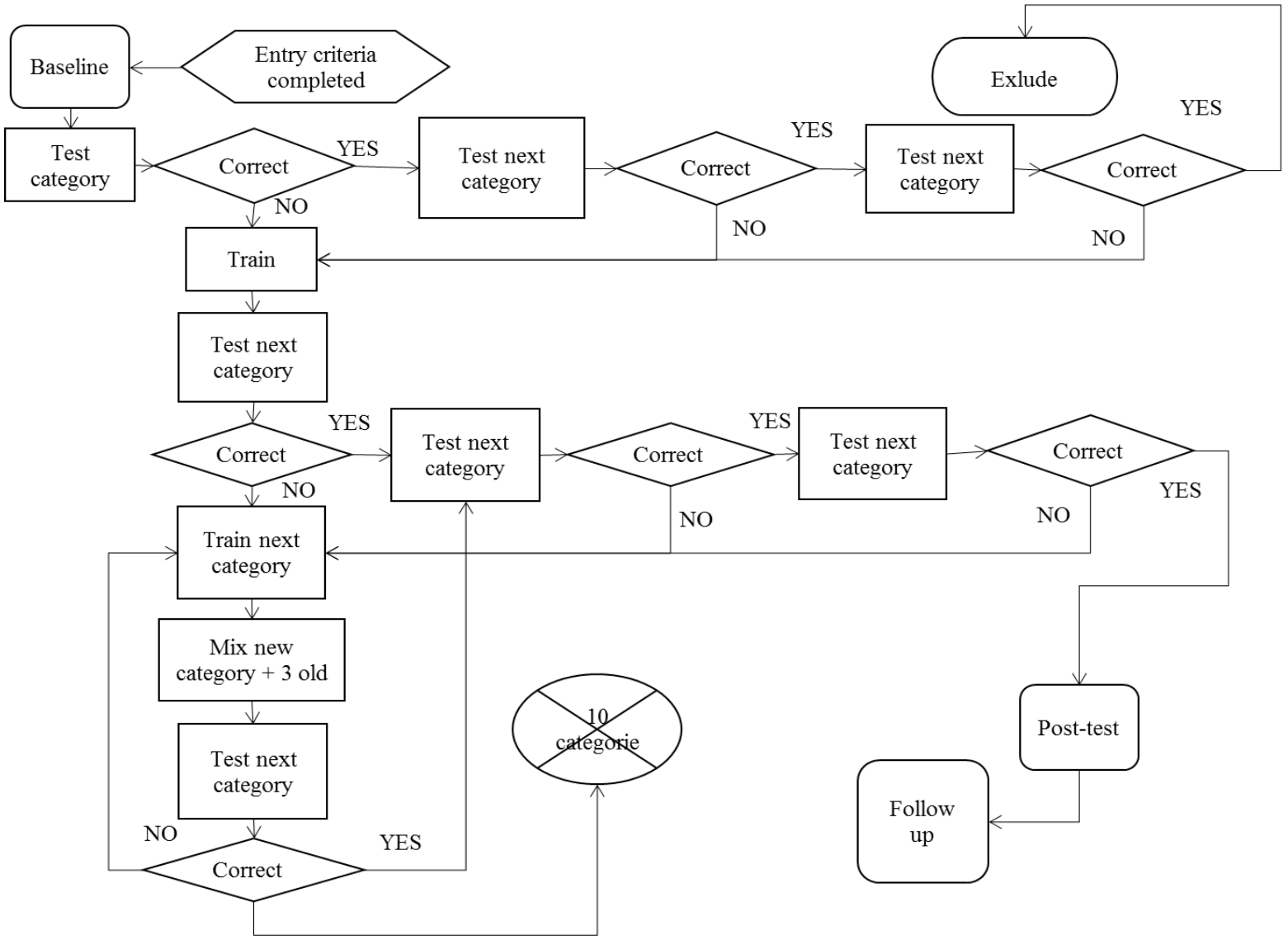

Figure 1. Flowchart – multiple exemplar training (MET).

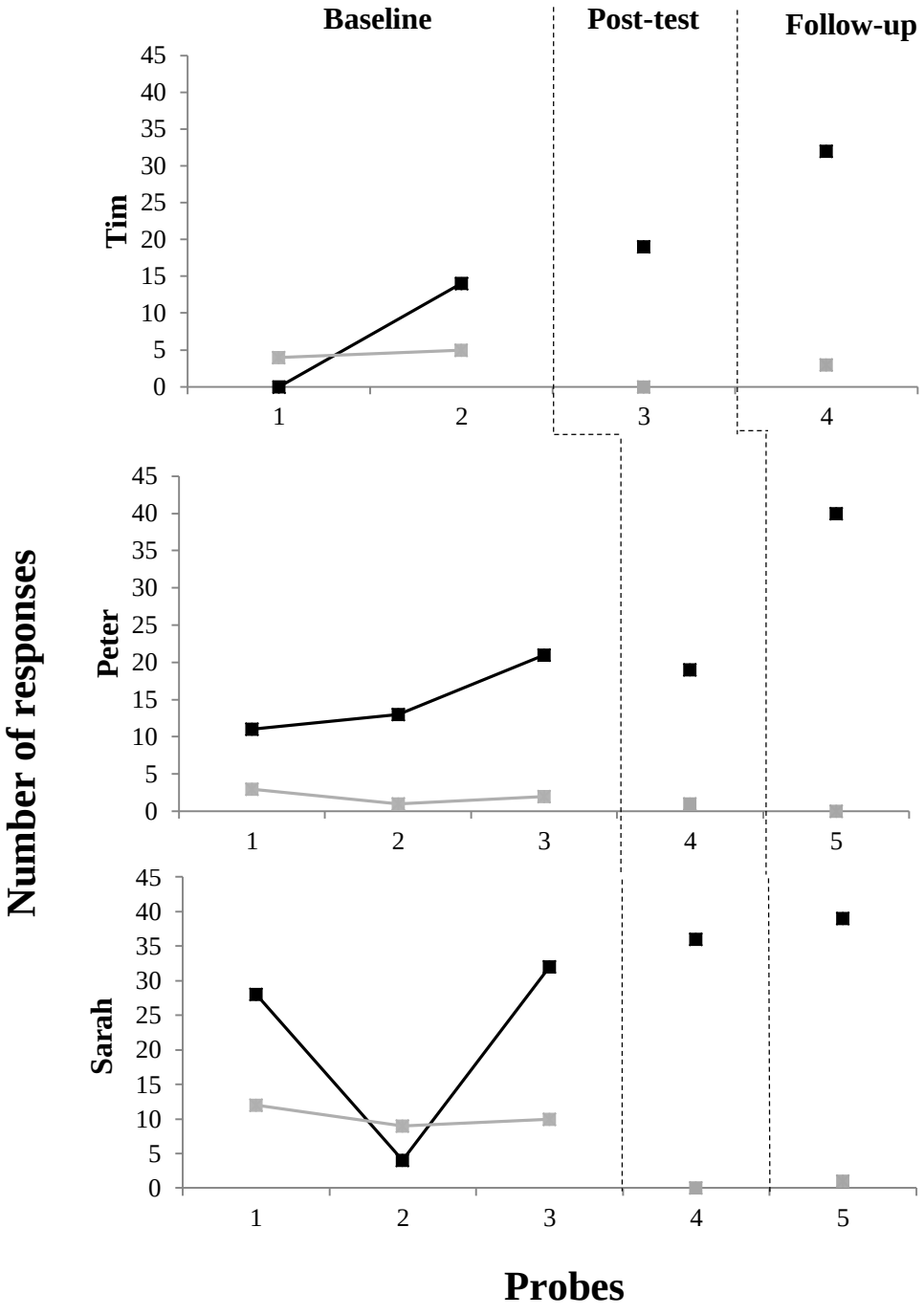

Figure 2. The number of items answered correctly and incorrectly across all categories in baseline, posttest and at follow up, Tim has a baseline over 2 days, Peter over 7 days and Sarah has a baseline over 14 days. Follow-up was 2 years after for Tim and 1 month later for Peter and Sarah. Black indicates correct responses and gray indicates incorrect responses.

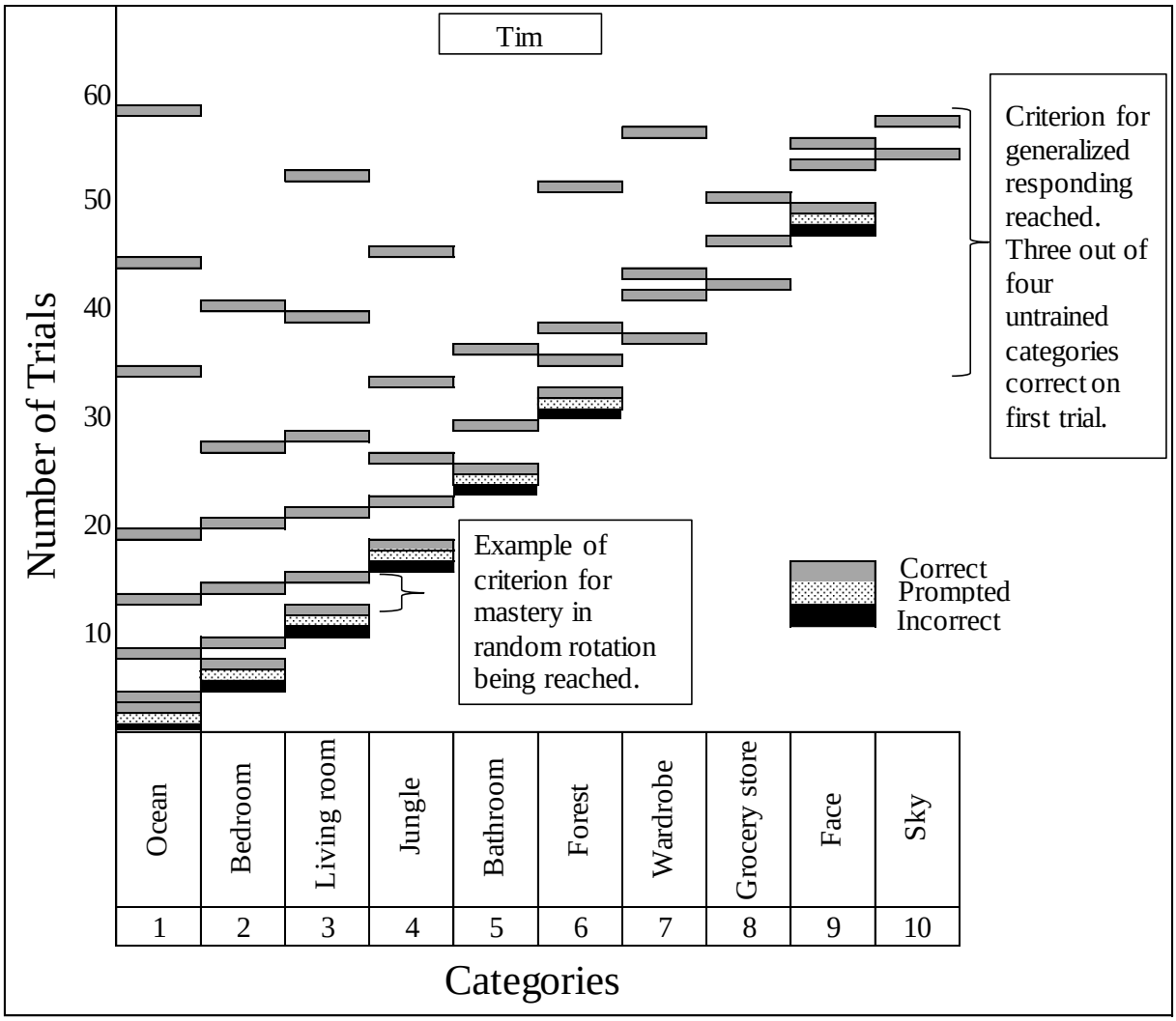

Figure 3. Trial-by-trial data, across categories, for Tim. The gray areas indicate a correct trial, the dotted area indicates a prompted trial and the black area indicates an incorrect trial.

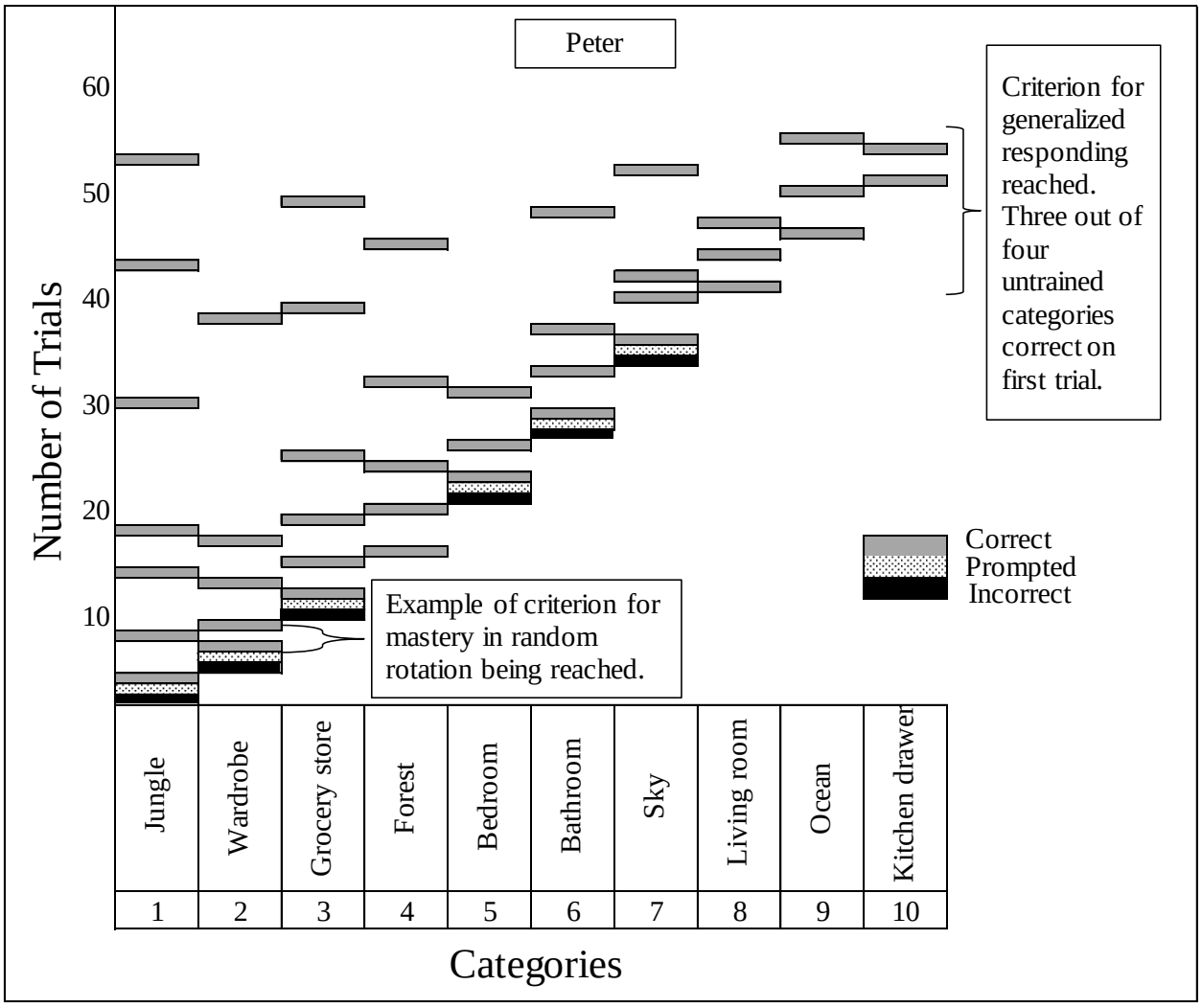

Figure 4. Trial-by-trial data, across categories, for Peter. The gray areas indicate a correct trial, the dotted area indicates a prompted trial and the black area indicates an incorrect trial.

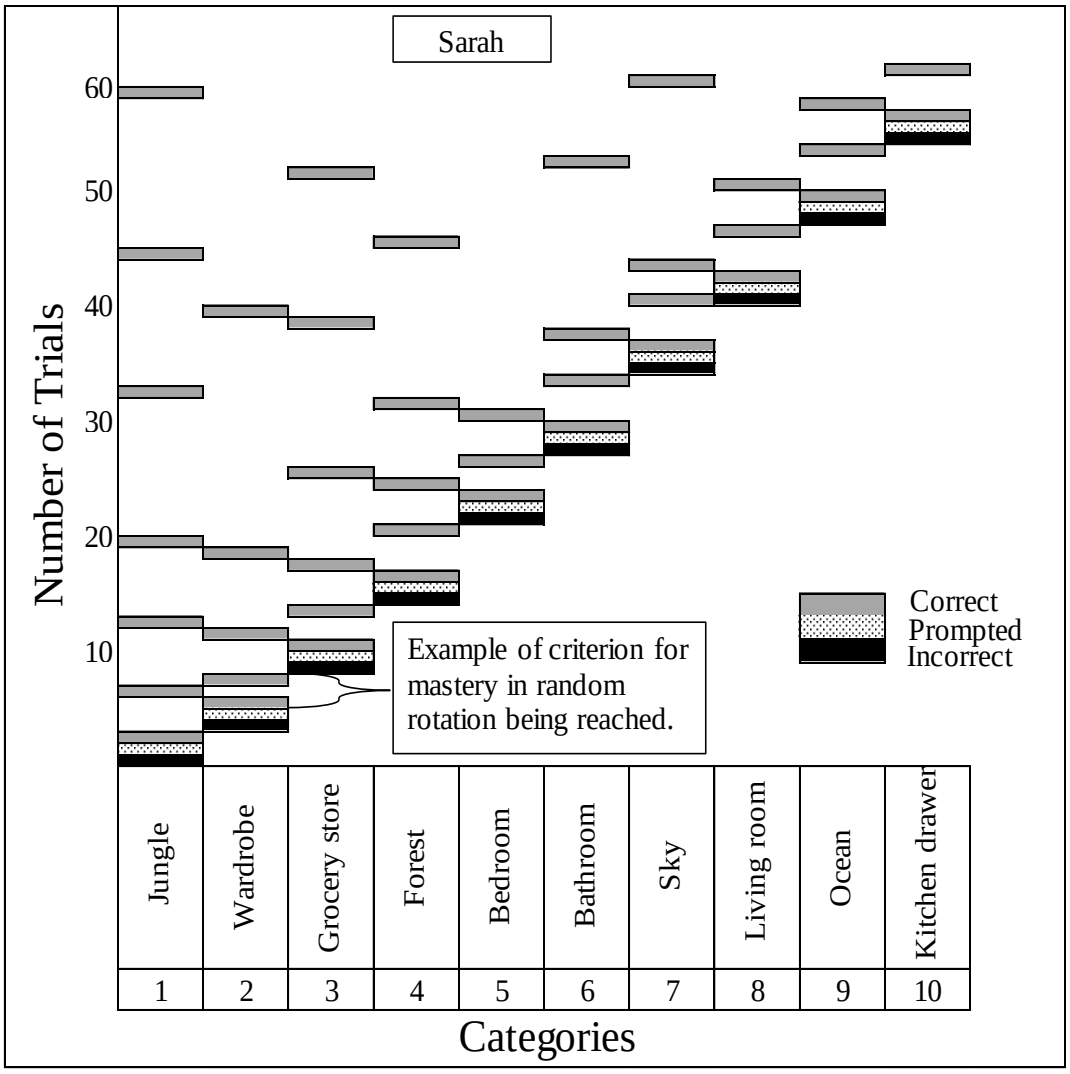

Figure 5. Trial-by-trial data, across categories, for Sarah. The gray areas indicate a correct trial, the dotted area indicates a prompted trial and the black area indicates an incorrect trial.

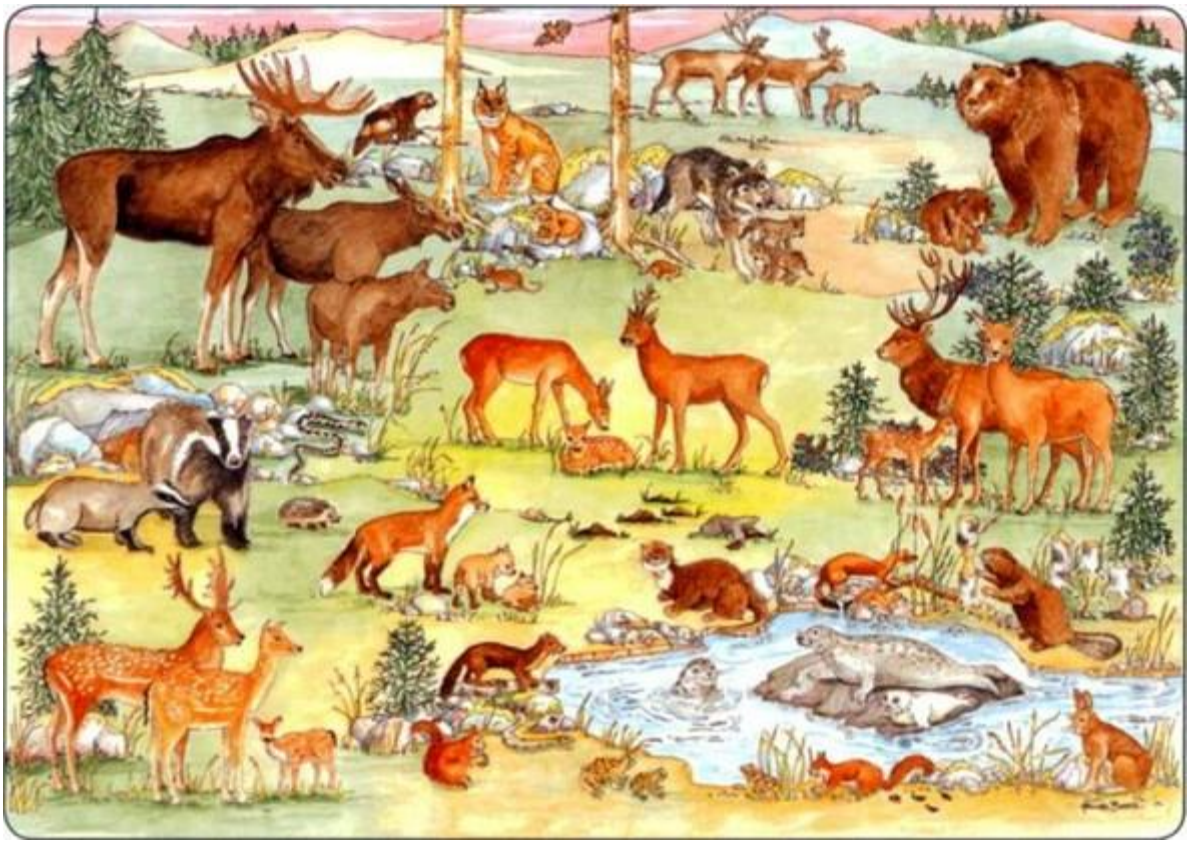

Figure 6. The figures show an example of teaching materials used in the study. This is the Forest category.

Appendix 1

Forespørsel om deltakelse i forskningsprosjektet

"Vil bruk av multiple eksemplartrening øke respondering innenfor intraverbal kategorisering?"

Bakgrunn og hensikt

Dette er et spørsmål til dere om å la barnet deres _____ delta i en forskningsstudie som undersøker om bruk av multiple eksemplartrening og visuelle hjelpemidler vil bidra til at han/hun kan gi flere svar på kategoriseringsspørsmål i tillegg til å generalisere dette til nye ukjente kategorier.

Hva innebærer studien?

Barnet vil først bli stilt ett spørsmål innenfor fire ulike generaliseringskategorier. De vil ta for seg hvor mange ting han/hun kan nevne innenfor kategorier som ikke skal trenes på. Dette blir gjort tre ganger før tiltak settes i gang og én til to ganger etter treningen er avsluttet. Så går man videre på selve intervensjonen. Her er det maks 10 kategorier som skal trenes. Kategorien vil først testes, det vil si han/hun vil bli spurt et spørsmål og vil få sjansen til å svare uten hjelp. Dersom han/hun ikke kan svare blir kategorien trent. Han/hun skal kunne klare å nevne fem ulike ting innenfor hver kategori før den er mestret. Når han/hun mestrer dette går man videre til neste kategori. Dersom han/hun klarer tre nye kategorier på første forsøk uten hjelp vil det ansees som om han/hun har mestret ferdigheten å kategorisere og de samme fire spørsmålene barnet ble spurt om før treningen vil bli stilt på nytt for å se hva han/hun svarer nå.

Mulige fordeler og ulemper

En mulig fordel vil være at han/hun kan lære seg å kategorisere gjennom multiple eksemplar trening. Han/hun må uansett lære dette og denne metoden er en måte å gjøre det på. En ulempe kan være at metoden ikke virker og at han/hun ikke lærer kategorisering denne måten.

Hva skjer med informasjonen?

Informasjonen som registreres skal kun brukes slik som beskrevet i hensikten med studien. Alle opplysningene og prøvene vil bli behandlet uten navn og fødselsnummer eller andre direkte gjenkjennende opplysninger. Det vil ikke være mulig å identifisere han/hun i resultatene av studien når disse publiseres.

Frivillig deltakelse

Det er frivillig å delta i studien. Du/dere kan når som helst og uten å oppgi noen grunn trekke ditt samtykke til å delta i studien. Dette vil ikke få konsekvenser for barnets videre oppfølging. Ønsker du/dere at barnet ditt/deres skal delta, undertegnes samtykkeerklæringen på siste side. Dersom du/dere senere ønsker å trekke deg eller har spørsmål til studien, kan du kontakte Elisabeth Ulvestad Rustebakke på elisabeth.rustebakke@nordvoll.gs.oslo.no eller 905 28 023

Utdypende forklaring av hva studien innebærer

Mange barn med autisme har vansker med å etablere gode kategoriseringsferdigheter. Tidligere studier har vist at de etablerer kategorier på en annen måte enn andre verbalt kompetente individer. (Minshew, Goldstein, Muenz, & Payton, 1992). Å lære å kategorisere er derfor et viktig ledd i språkopplæringen til disse barna.

Det er foreslått at verbalt kompetente individer tar i bruk ulike problemløsningsstrategier for å bedre kunne svare på spørsmål innenfor kategorisering (Sundberg & Michael, 2001). Det ser ut som at for å effektivt kunne kategorisere er det viktig å raskt kunne generalisere innenfor, og diskriminere mellom, klasser (Gasteb et al., 2006). Studien vil bruke multiple eksemplartrening og visuelle hjelpemidler (bilder av det barnet skal benevne) for å, forhåpentligvis, etablere flere objekter eller dyr innenfor en kategori.

Personvern

Opplysninger som registreres om barnet vil være hva han/hun svarer på de ulike spørsmålene. Det vil ikke bli spurt spørsmål av personlig karakter. Høgskolen i Oslo og Akershus ved administrerende direktør er databehandlingsansvarlig.

Rett til innsyn og sletting av opplysninger og sletting av prøver

Hvis du/dere sier ja til å delta i studien, har du/dere rett til å få innsyn i hvilke opplysninger som er registrert om barnet. Du/dere har videre rett til å få korrigert eventuelle feil i de opplysningene vi har registrert. Dersom du/dere trekker deg fra studien, kan du/dere kreve å få slettet innsamlede opplysninger, med mindre opplysningene allerede er inngått i analyser eller brukt i vitenskapelige publikasjoner.

Informasjon om utfallet av studien

Du/dere vil få beskjed om hvilke journaler studien eventuelt publiseres i og også få en kopi av den ferdige artikkelen.

Samtykke til deltakelse i studien
Jeg/vi er villig til at _____ deltar i studien

(Signert av foresatte, dato)

Jeg/vi er villige til at det tas video opptak i den hensikt å sikre reliabilitet og metodeintegritet. Video av barnet vil kun bli sett av fagkonsulenter på STI og eventuelt forskergruppa Anvendt og eksperimentell atferdsanalyse i klinisk praksis ved Høgskolen i Oslo og Akershus. Opptakene vil bli oppbevart og slettet etter gjeldende regler i henhold til Lov om behandling av personopplysninger og Arkivlova med forskrifter. Videosamtykket gjelder ut året 2015.

(Signert av foresatte, dato)

Jeg bekrefter å ha gitt informasjon om studien

(Signert, rolle i studien, dato)