J Dev Phys Disabil (2013) 25:5–15
DOI 10.1007/s10882-012-9311-3

ORIGINAL ARTICLE

On the Use of Strategies for Programming Generalization During Functional Communication Training: A Review of the Literature

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Published online: 30 October 2012

Abstract We conducted a review of the literature pertaining to Functional Communication Training (FCT) and the principles and tactics for programming generalization. Ten studies of FCT and generalization were identified, analyzed, and summarized using the framework provided by Stokes and Osnes (Behavior Therapist 20:337–355, 1989) that detailed principles and tactics programming generalization. In addition to the tactic of recruiting natural consequences which is inherent to FCT, several studies evaluated additional strategies for programming generalization during FCT including modification of maladaptive consequences, reinforcement of occurrences of generalization, training sufficient stimulus exemplars, programming common physical stimuli, and programming common social stimuli. The results of these studies suggest that a) FCT and the tactic of recruiting natural consequences is sometimes sufficient to produce generalization but not in every case, and b) generalization of the treatment effects of FCT can be enhanced through the use of specific tactics for programming generalization. Overall, the results of this review suggest that a relatively small number of studies of FCT have systematically evaluated generalization. Thus, future research should continue to evaluate specific strategies for programming generalization with FCT. This includes combining procedures such as recruiting natural consequences with other strategies outlined by Stokes and Osnes.

Keywords Functional communication training · Generalization

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Functional communication training (FCT) is an evidence-based treatment (Horner et al. 2005; Mash and Barkley 2003) in which challenging behaviors are replaced

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with appropriate communicative behaviors (i.e., mands; Carr 1988). FCT is currently among the most common reinforcer-based treatments for challenging behavior in the behavioral literature (Tiger et al. 2008).

Generally, when FCT is used, an antecedent (Carr and Durand 1985) or functional (Iwata et al. 1982/1994; Northup et al. 1991) analysis is first conducted to identify the variable(s) maintaining challenging behavior. An appropriate communicative response (e.g., signs, card exchange, voice output device activation), or mand, is then taught, which permits the individual to access the functional reinforcer through manding, and challenging behavior is placed on extinction (Fisher et al. 1993) or punished (Wacker et al. 1990). Numerous studies have demonstrated that FCT can be effective for reducing challenging behaviors and increasing functionally equivalent mands (Carr & Durand; Durand and Carr 1991, 1992; Wacker et al. 1990). Additional studies have shown the effectiveness of FCT across subgroups (e.g., Hagopian et al. 1998), topographies of behavior (e.g., Hagopian et al. 1998; Kurtz et al. 2003; Derby et a1. 1997), and settings (e.g. Northup et al. 1994; Wacker et al. 2005).

Although the success of FCT as a treatment for challenging behaviors has been demonstrated repeatedly in the literature, questions remain about the generality of the treatment (across people, settings, and stimuli) and the effectiveness of strategies for the specific programming of generalization with FCT. Stokes and Baer (1977) defined generalization as "the occurrence of relevant behavior under different, non-training 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" (p. 350). Stokes and Osnes (1989) provided a categorical system to extend the Stokes and Baer (1977) by providing descriptions of general principles of generalization programming and then reviewing specific tactics that typified each of the principles. Stokes and Osnes described three general principles of generalization including a) *exploitation of current functional contingencies* with specific tactics that included contacting natural contingencies, recruiting natural consequence, modifying maladaptive consequences, and reinforcement of occurrences of generalization; b) *training diversely* with specific tactics that included the use of sufficient stimulus exemplars, the use of sufficient response exemplars, making antecedents less discriminable, and making consequences less discriminable; and c) *incorporating functional mediators* with specific tactics that included the incorporation of comment salient physical stimuli, incorporation of common salient social stimuli, incorporation of salient self-mediated physical stimuli, and incorporation of salient self-mediated verbal stimuli.

Evaluations of strategies for programming generalization of FCT are important because it has been shown that generalization cannot be assumed following the successful implementation of the treatment (Schindler and Horner 2005). Our purpose was to review the behavioral literature on generalization of FCT to (a) identify the tactics that have been used to specifically program generalization of FCT treatment effects (including and beyond the strategy of recruiting natural consequences which is inherent in FCT), and (b) discuss the tactics for programming generalization of FCT within the framework provided by Stokes and Osnes (1989).

Methods

Search Methods and Inclusion Criteria

Studies were included in the review if they (a) utilized a single-subject design; (b) utilized FCT as a treatment for challenging behavior, and (c) involved an analysis of generalization across contexts, stimuli, or individuals. For the current review, studies from 1985 to 2012 were identified through a search of four electronic databases including Education Resources Information Center (ERIC), Medline, Psychology and Behavioral Sciences Collection, and PsychInfo using the keywords "Functional Communication Training" and "Generalization." Additionally, we reviewed the reference lists of the identified studies for the purpose of identifying additional articles for possible inclusion. The search yielded 23 papers, including book chapters, review articles, dissertations, discussion papers, and data-based studies. Of these papers, nine studies met inclusion criteria. Each of the nine studies was categorized using the framework provided by Stokes and Osnes (1989).

Results

FCT and Exploitation of Current Functional Consequences

Stokes and Baer (1977) referred to the contingencies of reinforcement that exist in an individual's environment as natural communities of reinforcement. Stokes and Baer suggested that increasing the likelihood that these communities of reinforcement will positively effect adaptive and maladaptive behaviors facilitates generalization. It was upon this notion that Stokes and Osnes (1989) based the principle of programming for generalization that they referred to as *exploitation of current functional contingencies*. The four tactics of *exploitation of current functional contingencies* described by Stokes and Osnes were (a) recruit natural consequences, (b) modify maladaptive consequences, (c) contact natural contingencies, and (d) reinforce occurrences of generalization.

Recruiting Natural Consequences The tactic of recruiting reinforcing consequences is implicit within FCT as a central component of the treatment. For example, Carr and Durand (1985) treated severe challenging behavior exhibited by four children with developmental disabilities. Following an experimental analysis that identified reinforcers for challenging behavior, treatment involved teaching the children to mand for those reinforcers. For example, functional analysis results suggested that restricted teacher attention was associated with the occurrence of challenging behavior for one child, and the communicative response "Am I doing good work?" was taught and resulted in teacher attention. In essence, the child was taught to recruit an identified reinforcer, which is consistent with the tactic of recruiting natural consequences for programming generalization.

Although Carr and Durand (1985) did not evaluate the generalization of trained mands across non-training conditions within the scope of their study, subsequent

studies examined generalization in the absence of additional tactics for programming generalization (e.g., Durand and Carr 1992; Moes and Frea 2002). For example, Moes and Frea (2002) implemented FCT with three children with autism after the reinforcers maintaining challenging behavior were identified. Each child was taught functional mands within specific training routines (e.g., work activities; when their mothers' attention was diverted). When challenging behavior decreased and the mands occurred at elevated rates during the training routines, generalization was evaluated in additional routines not associated with training. Each child engaged in elevated levels of manding and low levels of challenging behavior during the non-training routines demonstrating generalization of FCT. These results showed that FCT can produce generalization via the tactic of recruiting reinforcement alone.

Although recruiting natural consequences is present within FCT, it is important to note that generalization is not always achieved without additional generalization programming. For example, after identifying the functions of challenging behavior, Schindler and Horner (2005) implemented FCT with three children diagnosed with autism. FCT was implemented in a one-on-one, preschool setting and generalization was evaluated in two additional settings (i.e., another room at the preschool; at home). Prior to the implementation of FCT in the one-on-one setting, the investigators evaluated the occurrence of mands and challenging behavior in the two additional settings when a "low-effort" intervention was in place (i.e., communication card, prompts to use the cards, extinction of challenging behavior). High levels of challenging behavior and low levels of mands were observed in the non-training settings when the low effort intervention was implemented prior to the implementation of FCT in the one-on-one setting. When FCT was implemented in the one-on-one setting, the low-effort intervention was removed from the two additional settings; and baseline conditions were implemented to evaluate generalization effects. Although positive treatment effects were achieved in the one-on-one setting, levels of mands and challenging behavior did not change in the generalization settings. These results suggested that although mands were successfully trained in one setting, generalization did not occur in additional non-training conditions (i.e., across settings, individuals, and work and/or item stimuli). Thus, the results of Moes and Frea (2002) suggested that the tactic of recruiting natural consequences for programming generalization may be sufficient in some cases; but not in all cases.

Modification of Maladaptive Consequences Extinction of challenging behaviors is often a component of FCT, and previous studies have suggested that it is frequently a necessary part of treatment (e.g., Fisher et al. 1993). Other studies have demonstrated the need for a punishment component for challenging behavior coupled with the reinforcement of mands during FCT (Wacker et al. 1990). The inclusion of extinction or punishment components within non-training conditions following the successful implementation of FCT is consistent with the tactic of modification of maladaptive consequences. For example, Wacker et al. (2005) evaluated generalization effects of FCT with 12 children who engaged in challenging behaviors maintained by escape from non-preferred activities. Following successful implementation of FCT with a set of training stimuli, generalization probes were conducted with each child across untrained stimuli while extinction of challenging behavior was in place. For seven of the children, a substantial reduction in challenging behavior occurred during post-

FCT probes with each of the untrained stimulus conditions. With the other five children, generalization occurred after treatment was implemented with the untrained stimuli. Wacker et al. (2005) provided an example in which maladaptive consequences for challenging behavior were modified during successful generalization programming. However, the results also showed that generalization is not always achieved in cases in which the modification of maladaptive consequences tactic is used even in combination with the tactic of recruiting natural consequences.

Other studies have shown that modification of maladaptive consequences is not always a necessary component for programming generalization with FCT (i.e., Durand and Carr 1992; O'Neill and Sweetland-Baker 2001). For example, O'Neill and Sweetland-Baker coupled FCT with escape extinction to treat challenging behavior with two students diagnosed with autism. After conducting functional analyses showed that challenging behavior was maintained by escape from work, the investigators implemented FCT and extinction with one task for each student. When low rates of challenging behavior and elevated rates of manding were observed with each child, the investigators conducted probe sessions with additional tasks. During probe sessions, manding was not prompted, as was done during FCT; and extinction was not in place. Positive effects were observed with some of the additional tasks for each child as shown by low levels of challenging behavior and high levels of mands in the absence of extinction. The results were mixed, however, in that with some tasks, challenging behavior was observed at high levels and mands were observed at low levels. These results showed that with some tasks, modification of maladaptive consequences was not required to achieve successful generalization of FCT effects.

Contact Natural Consequences and Reinforce Occurrences of Generalization The results of Schindler and Horner (2005) suggested that is important to actively consider the tactics of contacting of natural consequences and reinforcement of occurrences of generalization when programming for generalization during FCT. Although FCT had been successfully implemented in a training setting, generalization did not occur with novel trainers who received no instructions on the reinforcement of mands. Instruction to care providers may not always be needed to produce high integrity regarding the reinforcement of mands (e.g., Durand and Carr 1992), but the results of Schindler and Horner suggested that reinforcement of mands within non-training settings should be evaluated to insure that mands are contacting natural consequences. Otherwise, the recruitment of reinforcement aspect of FCT will likely be ineffective and generalization will either not occur or will not be sustained over time.

FCT and Training Diversely

A second principle of programming generalization described by Stokes and Osnes (1989) is *training diversely.* Stokes and Osnes asserted that rigid training procedures are less likely to result in widespread effects across non-training conditions. Rather than tightly focused training with little variation in antecedents, behaviors, and consequences, the principle of *training diversely* involves systematic variation of these variables during training. The four tactics of *training diversely* described by Stokes and Osnes were (a) use of sufficient stimulus exemplars, (b) the use of

sufficient response exemplars, (c) making antecedents less discriminable, and (d) making consequences less discriminable.

Training Sufficient Stimulus Exemplars Wacker et al. (2005) provided an example of the use of sufficient stimulus exemplars to program for generalization of a trained mand (i.e., pointing at preferred items). As described above, five of the seven children in the Wacker et al. (2005) study did not demonstrate generalization following FCT. Therefore, treatment was implemented with additional tasks before generalization was again evaluated. Following the implementation of treatment with the additional tasks, substantially less training time was required, indicating generalization (Stokes & Baer, 1977).

Training Sufficient Response Exemplars To date, no studies have systematically evaluated sufficient response exemplars to program for generalization during FCT. However, several studies have evaluated this tactic to program for generalization of communication responses in the absence of challenging behavior (i.e., Buzolich et al. 1991; Conaghan et al. 1992; Dyches et al. 2002; Harchik et al. 1990) and may provide some guidance for its use with FCT. For example, Dyches et al. conducted communication training with a 17-year-old diagnosed with multiple disabilities using two augmentative communication devices. One device was a pictographic display with 11 symbols (e.g., "want," "bathroom," "French fries," etc.) and the other device was a voice-output communication aid that had an overlay with similar symbols. Following successful communication training in the adolescent's classroom with each device, generalization probes were first conducted across multiple school personnel in novel settings within the school and then in the community. High levels of appropriate communication were observed during the generalization probes both within the school setting and in the community with each of the communication modalities. These results provide evidence of the potential effectiveness of this tactic with FCT in programming for generalization.

FCT and Incorporation of Functional Mediators

The third principle of programming for generalization described by Stokes and Osnes (1989) was *incorporation of functional mediators*. This principle is based on the notion that various types of stimuli can be programmed to facilitate the spread of treatment effects to non-training conditions. Programmed stimuli are typically present within the training conditions while treatment is in place and are then transferred to non-training conditions. Stokes and Osnes suggested that programming stimuli in this way results in their taking on discriminative properties in non-training conditions that lead to the occurrence of desired generalization. The four tactics of *incorporation of functional mediators* described by Stokes and Osnes were (a) incorporate common salient physical stimuli, (b) incorporate common salient social stimuli, (c) incorporate salient self-mediated physical stimuli, and (d) incorporate salient self-mediated verbal stimuli.

Programming Common Physical Stimuli Durand (1999) provided an example of the use of programming common physical stimuli in the programming of generalization

of FCT effects across settings and people. In that study, functional analyses were conducted with five children diagnosed with various disabilities to identify variables maintaining challenging behavior. FCT was then implemented with each child in the classroom using voice-output devices. When each child was engaging in high levels of manding with the assistive devices and low levels challenging behavior, assessments of generalization were conducted in the community. Results suggested that generalization was successfully programmed as the individuals consistently used the voice-output devices to mand across multiple settings in the community. Further, low levels of challenging behavior occurred in the community even though there were no programmed contingencies (i.e., extinction, punishment). It is plausible that the presence of the voice-output device in the training and community settings represented a common mediating physical stimulus that facilitated the occurrence of generalization (Durand 1999; Falcomata et al. 2010; Franco, et al. 2009).

Other examples of this approach focused on specific modalities of manding (e.g., Chambers and Rehfeldt 2003; Dyches et al. 2002). Although these are not studies of FCT, they provide examples of assistive devices as common physical stimuli for programming generalization. For example, Chambers and Rehfeldt compared the generalization of manual signs and the use of a Picture Exchange Communication System (PECS) following communication training with four individuals who had diagnosed disabilities. The results suggested that the individuals learned the PECS modality quicker than they learned the manual signs. In addition, generalization was enhanced with the PECS modality relative to manual signs with three of the five individuals. These results support the results of Durand (1999) and others (e.g., Falcomata et al. 2010; Franco et al. 2009) in suggesting that common physical stimuli can play a positive role in the programming of generalization of FCT.

Programming Common Social Stimuli The tactic of programming common social stimuli consists of programming for the acquisition of discriminative properties of individuals, therapists, or peers within training conditions to facilitate generalization to non-training conditions (Stokes and Osnes 1989). Durand and Carr (1991) provided an example of the use of therapists as common social stimuli for programming generalization. Durand and Carr successfully implemented FCT in a training setting before generalization was tested across multiple settings, tasks, and teachers. Training was carried out with the additional tasks across multiple instructional settings with the trainers before they were faded out of the instructional settings and the regular teachers were faded in. High levels of manding and low levels of challenging behavior generalized to the classroom teachers, even though they were given no instruction about the procedures or how to respond to challenging behaviors (i.e., extinction was not programmed).

Discussion

We reviewed the literature on FCT pertaining specifically to the generalization of the treatment and discussed the identified studies within the framework provided by Stokes and Osnes (1989). A total of eight studies were identified that included FCT

and specific evaluations of generalization of the treatment and tactics for programming for generalization. The results of the review revealed that several principles and tactics in addition to recruiting natural consequences (a tactic for programming generalization implicit to FCT) have been used to program for the generalization of FCT including the exploitation of current functional consequences (e.g., modification of maladaptive consequences; reinforcement of occurrences of generalization), training diversely (e.g., use of sufficient stimulus exemplars), and the incorporation of functional mediators (e.g., incorporating common salient physical stimuli; incorporating common salient social stimuli). The results also revealed that several tactics for programming generalization outlined by Stokes and Osnes have not been evaluated with FCT (i.e., make antecedents less discriminable; make consequences less discriminable; use of sufficient response exemplars; incorporate self-mediated physical stimuli; incorporate self-mediated verbal and covert stimuli). The results of the current review suggest several implications and potential future avenues of research regarding FCT, the generalization of the treatment, and tactics for programming generalization of FCT.

First, the presence of the tactic of recruitment of natural consequences, which is inherent to FCT procedures, is sometimes sufficient to bring about generalization. However, this component did not always facilitate generalization (e.g., Schindler and Horner 2005). In some cases, additional tactics were required to successfully occasion generalization. Thus, future research should evaluate the conditions under which the tactic of recruitment of natural consequences is sufficient to produce generalization; and the conditions under which additional tactics are needed. When considering combining tactics for programming generalization of FCT, it is possible that the use of multiple tactics will affect treatment fidelity (i.e., the extent to which care providers have the ability to accurately implement the procedures) and the feasibility of the treatment. Thus, future research should evaluate the combination of different tactics while also considering the feasibility of the procedures given various, individualized environmental circumstances.

Second, additional research should be conducted on the use, value, and feasibility of other specific tactics that have not been evaluated with FCT. For example, no studies have evaluated the tactic of using multiple response exemplars for programming generalization of FCT. Training multiple response exemplars may hold specific promise in the generalization of FCT and in helping to overcome challenges to treatment (Wacker et al. 1990). Wacker et al. described potential challenges to treatment as including failures to reinforce trained mands and intermittent reinforcement of challenging behavior. It is possible that training multiple mands during FCT will increase the likelihood individuals will engage in a variety of multiple mand topographies rather than challenging behavior in generalization settings when lapses in treatment integrity occur in the form of failures to reinforce mands. Said another way, training multiple mand topographies during FCT (i.e., training multiple response exemplars) may prevent the resurgence (Volkert et al. 2009; Wacker et al. 1990) of challenging behavior in favor of the use of mands during challenges to treatment; and thereby facilitating successful generalization. Thus, future studies should evaluate the use of the tactic of training multiple response exemplars with FCT and its effect on the resurgence of challenging behavior during challenges to treatment and subsequent successful generalization of the treatment.

Third, although a large and increasing number of studies have been conducted on FCT (123 data-based FCT studies identified by Psychinfo), the current review showed that a relatively small number of studies have evaluated FCT and tactics for programming for generalization. Thus, although the results of the current review were positive in terms of the use of FCT alone and in combination with various tactics for programming generalization, the relatively small number of studies in the identified literature base suggests that additional research is warranted in this area.

In summary, the effectiveness of FCT procedures has been demonstrated in many studies in the behavioral literature. Further, studies conducted in the area of generalization and FCT suggest that the treatment is often robust either alone or in combination with other tactics for programming generalization in terms of its effectiveness across stimuli, individuals, and settings. However, the relatively small number of studies that have evaluated FCT, generalization, and the use of tactics for programming generalization suggest the "operant pursuit of generalization" (Stokes and Osnes 1989) continues to be essential with regard to FCT Table 1.

Table 1 Article Author(s), tactics for programming generalization, participant age, participant characteristics, and outcome

Authors	Tactic(s) for Programming Generalization	Participants	Participant Characteristics
Berg et al. (2007)	Recruit natural consequences; Modification of maladaptive consequences	Children	Developmental Disabilities, Autism
Durand and Carr (1991)	Recruit natural consequences; Modification of maladaptive consequences	Children	Autism
Durand and Carr (1992)	Recruit natural consequences	Children; Adolescents	Developmental Disabilities
Falcomata et al. (2010)	Recruit natural consequences Programming common physical stimuli	Children	Autism
Franco et al. (2009)	Recruit natural consequences; Programming common physical stimuli	Children	Autism
Moes and Frea (2002)	Recruit natural consequences; Modification of maladaptive consequences	Children	Autism
O'Neill and Sweetland-Baker (2001)	Recruit natural consequences; Modification of maladaptive consequences	Children	Autism
Schindler and Horner (2005)	Recruit natural consequences; Modification of maladaptive consequences	Children	Autism
Wacker et al. (2005)	Recruit natural consequences; Use of sufficient stimulus exemplars	Children	Various

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