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Selecting a Response Form for Nonverbal Persons: Facilitated Communication, Pointing Systems, or Sign Language?

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The three major types of augmentative communication for nonverbal persons consist of writing (or typing), pointing, and signing. These alternative response forms are examined in terms of their advantages and disadvantages for establishing effective verbal behavior. In addition, these systems are examined using the concepts from Skinner's (1957) analysis of verbal behavior (i.e., mand, tact, intraverbal, and autoclitic). The results of this analysis show that sign language has the most advantages and the fewest disadvantages, and more closely parallels speech in terms of the verbal operants. Although, the current trend is to favor facilitated communication (typing) and pointing systems, both of these response forms have several disadvantages that impede the development of the verbal operants. It is suggested that for many nonverbal individuals sign language is a better alternative response form, and has a better chance of improving speech.

The recent interest in facilitated communication (FC), especially by the media, has drawn substantial attention to the language needs of nonverbal persons. However, many of the issues concerning how to best meet these needs remain unresolved. It is clear that many developmentally disabled (DD) individuals with severe language disorders can benefit from some type of augmentative communication (for a review, see Zangari, Lloyd, & Vicker, in press). But questions as to which augmentative system might be the most effective for an individual, and how to best teach verbal behavior to nonverbal persons, have become more complicated by the entrance of FC into this already controversial arena. A close look at the different augmentative systems using both structural and functional analyses may clarify some of these issues.

A critical element in establishing a language intervention program for a nonverbal person is selecting a response form. That is, what type of response topography should be used for developing the verbal repertoires? There are four general options: (1) speech, (2) independent writing or typing, or facilitated communication, (3) pointing and exchange systems (including computer generated speech), and (4) sign language. There is an extensive body of research on each of these alternatives; however, there is relatively little empirical or conceptual research comparing them (for a review, see Shafer, 1993). Often decisions to use one system or another are based on the personal preference of the trainers, rather than on the student's individual abilities and needs, or on any empirical evidence supporting a specific system (Reichle, Sigafoos, & Remington, 1991). The purpose of the current paper is to use the concepts from Skinner's (1957) analysis of verbal behavior to examine the different response form options for a nonverbal person.

SPEECH AS THE PRIMARY GOAL

Speech is the most desired response form for verbal behavior for a number of reasons. Perhaps the most significant advantage of speech is the availability of a large verbal community that can easily prompt and reinforce vocal verbal behaviors without special training. In addition,

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this sizable number of speakers produces endless vocal models which are often paired with strong forms of reinforcement, resulting in specific speech sounds and patterns becoming conditioned reinforcers. In addition, these pairings may establish vocalizations as automatically reinforcing, thereby naturally strengthening vocal behavior (Bijou & Baer, 1965; Skinner, 1957; Vaughan & Michael, 1982). As a result, vocal behavior can be the easiest form of verbal behavior for humans to acquire, as evidenced by the rapid acquisition of speech by most children even though parents have no special training. Vocal behavior is also portable, and responses can be emitted quickly and efficiently. However, if speech fails to develop in the typical manner, which is often the case for many developmentally disabled (DD) children, speech may become a difficult response form to establish.

There are many causes for delayed or defective language development, both organic and nonorganic (Drash & Tudor, 1993). However, it is clear that the longer a child goes without speaking, the more difficult it becomes to establish vocal behavior (Lovaas, 1977; Van Riper, 1978). Direct speech therapy, while often very effective, may not establish speech for some individuals, especially for those who have long histories of failing to communicate. The response forms required for speech may simply be too hard to emit for some nonverbal children, especially for those who have very little vocal behavior under echoic control. For these individuals, an alternative response form may be the most effective way to generate successful verbal behavior (Zangari et al., in press). However, the ultimate objective when teaching verbal behavior is still to establish vocal response forms. The three most common types of augmentative communication, writing, pointing and signing, may all be effective, but only for specific students and under certain circumstances. These alternatives to speech and the issues involved in their use will now be examined.

SPELLING, WRITING, TYPING, AND FACILITATED COMMUNICATION

There are a number of nonvocal persons who can effectively communicate by spelling out words. Many disabled individuals have demonstrated the independent use of this form of responding (e.g., LaVigna, 1977). Perhaps most obvious is its value to deaf individuals and persons with cerebral palsy (CP). Also, many individuals with traumatic brain injury (TBI) retain their ability to read and write, even though they are unable to speak. Finally, there are a number of individuals with autism who are nonvocal but have demonstrated the ability to read and write. Rimland (1964) identified these autistic individuals as "criptic savants." While less desirable than speech, spelling words as a type of verbal behavior can be effective. For example, a person can use written words to ask for reinforcers (mand), identify nonverbal stimuli (tact), and engage in conversations (intraverbal). These repertoires require a number of prerequisite behaviors, such as those involved in literacy. However, this form of verbal responding can be effective for establishing all types of verbal behavior for a nonvocal person. If a person can independently write (or type), but can not speak, then this repertoire should certainly be used. If a person does not independently speak or write, then other alternative communication methods should be considered. The current paper will focus primarily on these other alternatives.

The recent technique of facilitated communication makes use of transcription, but differs in many important ways from the independent verbal behavior discussed above. Facilitated communication involves a response form consisting of spelled-out words, produced by typing or pointing to letters, with the assistance of a facilitator who guides the learner's arm, hand, or finger (Biklen, 1990; Haskew & Donnellan, 1992). The basic premise is that the facilitation allows a nonverbal person to emit verbal behavior that he already possessed, but had been unable to emit due to global apraxia (Biklen, 1990).

FC as a form of verbal behavior has produced a substantial amount of attention from the media, due to demonstrations of sophisticated levels of responding being emitted by previously nonverbal students. Proponents of FC have claimed that many previously nonverbal developmentally disabled individuals can demonstrate near normal levels of verbal functioning through facilitation (Biklen, 1990; Haskew & Donnellan, 1992). However, several recent studies have demonstrated that in almost all cases examined, the facilitator was the individual emitting the verbal behavior (e.g., Green & Shane, 1993; Wheeler, Jacobson, Paglieri, & Schwartz, 1993). In a few cases, it appears that some individuals do have the necessary prerequisite repertoires, and could possibly benefit from FC. Therefore, a closer look at FC is warranted.

Advantages of Facilitated Communication

Facilitation may be effective in generating verbal behavior in previously nonvocal individuals for a number of reasons (Table 1). First, facilitation allows a trainer to easily get an individual to emit a response. That is, many students are willing to have their hands touched and guided, and with especially cooperative individuals, it may seem much easier than teaching words or signs. It may be possible that some individuals can already emit textual and transcriptive behaviors, but refuse to do so, or will not do so without prompts. The facilitation may also allow for the easier emission of previously strengthened responses including mands, tacts, intraverbals, and autoclitics. This may be most probable with individuals suffering from certain types of traumatic brain injury (TBI), or individuals with Cerebral Palsy (CP), and perhaps even some individuals with autism. In addition, there are a number of DD persons who have become elective mutes and have later been found to have strong verbal behavior including the textual and transcriptive repertoires.

Certain students may learn to communicate with FC because facilitation provides access to strong reinforcers (physical contact, one-to-one attention). Subjects with strong establishing operations (EOs) for this type of reinforcement may be very successful with FC. Also, many of the individuals who enter an FC program may be coming from a near extinction reinforcement schedule. They now have easy access to strong and consistent reinforcement, and it might not be surprising to observe a learning rate never demonstrated before by the individual. FC may also capitalize on existing functional equivalence relations such as those formed between written words, spoken words, and objects (Hall &

Table 1
The advantages and disadvantages of facilitated communication.

Advantages of Facilitated Communication (FC)
The response form is easy to establish with facilitation
FC may capitalize on existing verbal operants (especially for elective mutes, those with CP, TBI, and some autistic individuals)
FC training may provide a powerful schedule of reinforcement change, sometimes from near extinction to CRF
FC may capitalize on existing functional equivalence relations (e.g., written-words with spoken-words or objects)
The response form is written English, so the literate listener does not need any special training to react to the response
Transcriptive and textual behaviors are topography-based verbal behavior
The response form of FC may not be associated with any negative emotional history related to speech (aversive pairings)
Disadvantages of Facilitated Communication
The response form is dependent on two types of environmental support: access to a keyboard and physical prompts from a trained facilitator; therefore, the student may not be able to emit verbal behavior in the natural environment when EOs and S^Ds are strong
With FC there are frequently problems with generalization to other facilitators and parents, this is especially problematic because of the financial burden of a trained facilitator
The response form (typed words) involves a very complex type of verbal behavior; the student must be able to scan and discriminate among a wide array of textual stimuli, be able to spell and type, and be able to emit a complex chain of behaviors involving conditional and multiple discriminations
There is an extremely slow response time compared to speech and sign, and the controlling variables and listener's attention can be easily lost

Chase, 1991). A final advantage of FC presented here is that the listener does not need any special training to react to the response. Most adults working with this population enter the profession as effective readers. However, as long as a facilitator is involved in the response form it will be difficult to determine exactly who is the speaker (Hall, 1993). It is likely though, that some literate individuals may be emitting their own mands, tacts, and intraverbal responses through the help of facilitation.

Disadvantages of Facilitated Communication

There are several complications with FC as a type of verbal behavior which make it a relatively undesirable response form (Table 1). Perhaps the most problematic, is the fact that successful verbal interaction is dependent on two types of environmental support. First, in order to verbally interact the speaker must have access to the keyboard. Second, a trained facilitator must be present to physically prompt the response. These requirements seriously limit the opportunities to engage in verbal interactions. If the keyboard is not available (e.g., in another room or building, broken, or no access to a power source), or if the facilitator is absent, verbal responses cannot occur. In addition, the need for a facilitator places a financial burden on the student which may be impossible to maintain over time. This problem, along with the common problems of generalization to other facilitators and parents, makes it quite likely that a person will spend a substantial amount of time without a facilitator. As a result of these limitations, FC is a highly restrictive form of verbal behavior that could not make much use of the contingencies in the natural environment, which play a critical role in shaping verbal behavior.

If the student is not literate, then FC would be an extremely complex response form to use to shape verbal behavior. There are several behavioral repertoires which are necessary for the successful emission of verbal behavior in this manner. First, the speaker must acquire letter discrimination skills and be able to scan and discriminate among a wide array of stimuli in order to find and type (or point to) the letters when needed. In addition, the speaker must be able to spell the words to emit the correct sequence of letters needed to make functional words. Finally, the speaker must be able to emit this complex chain of behaviors involving conditional and multiple discriminations in a relatively rapid manner in order to affect a listener in a timely way (if the response is too slow controlling variables or the listener's attention can be easily lost). Facilitation may seem to avoid the need for the student to have these repertoires, but if the student is not literate he cannot be the primary speaker.

An Analysis of FC Using the Concepts From Skinner's Book Verbal Behavior

The mand repertoires. Mands, which are controlled by EOs and specific consequences (Michael, 1988; Skinner, 1957), are an important type of verbal behavior. When an EO is in effect, manding may lead to specific reinforcement. In other words, when someone wants something, a mand may get it for them. However, EOs occur under a wide variety of conditions in the natural environment. In order to effectively mand, a speaker must have a response form readily available. A typical mand repertoire will be difficult to develop using FC because the response form may not be quickly available to the student when EOs are naturally strong (e.g., an EO for a specific food). The facilitator may be unavailable, or the typing device may not be immediately accessible, especially if the person is highly mobile. This lack of an available response form in the natural environment may lead to aggression, SIB, or other types of negative behavior which have been reinforced as mands in the past. In addition, the mand training that would be possible, would be restricted to mostly contrived EOs occurring under a limited set of conditions involving sitting at the keyboard with the facilitator present. This type of training may also involve multiple control, in that other verbal and nonverbal

stimuli are frequently present during training, making generalization and pure mands less likely.

The tact repertoires. Tacts, which are verbal responses controlled by nonverbal stimuli, would be limited to nonverbal stimuli presented while the facilitator was present. The number of tacts emitted or acquired would also be related to the facilitator's ability to present nonverbal stimuli to the student. Because the facilitator's hands are busy facilitating, this task may be particularly difficult. Also, attending to the letters on the keyboard may compete with attending to visual, nonverbal stimuli. Furthermore, tacting like all the other verbal operants would be impossible to emit in the natural environment without the facilitator or the FC device. Therefore, it would be difficult to develop a typical tact repertoire using FC. Even if the tacts were already strong in the student's repertoire the opportunities to emit them are restricted, which may evoke negative behaviors.

The intraverbal repertoires. Intraverbal behavior, which consists of verbal responses controlled by nonmatching verbal stimuli, would also be limited to verbal stimuli presented while the facilitator was present. However, verbal stimuli are easy to present while using FC, which is probably why much of the typical FC training involves intraverbal behavior consisting of questions and answers. An interesting problem arises with the use of transcriptive behavior as a response form in intraverbal interactions. An intraverbal that would be completely consistent with the response form of transcription would involve verbal stimuli presented in the textual form which would control typed responses. However, the typical intraverbal interactions with FC consist of spoken words and typed responses. This interaction involves the mixing of two different response forms. It is unclear what the effects, if any, this would have on verbal development. This same problem arises in the analysis of receptive behavior, and in the development of intraverbal and receptive behavior with pointing systems.

The codic repertoires. Codic behavior (Michael, 1982) consists of textual (reading) and transcriptive (writing and spelling) behaviors, and are the prerequisite repertoires for FC. If a student fails to empirical demonstrate these skills it would be impossible to say that he was the person emitting mands, tacts, intraverbals, or autoclitics.

The autoclitic repertoires. Skinner (1957) distinguishes between primary verbal behavior (e.g., mands, tacts, intraverbals) and secondary verbal behavior (autoclitics). Secondary verbal behavior never stands on its own, rather it is always caused by some aspect of a primary verbal operant. For example, a speaker can modify a primary tact such as *It's a moose* with the qualifying autoclitic *I think,* resulting in the total response of *I think it's a moose. I think* is an autoclitic tact that enjoins the listener to react to the primary tact involving a nonverbal stimulus and the word *moose* with caution. If the variables controlling the primary tact were stronger the speaker may have emitted the response *I'm sure it's a moose,* resulting in a different effect on the listener. Autoclitic behavior can be considered "verbal behavior about verbal behavior" (Peterson, 1978), and is reinforced by the special effects it has on listener behavior.

Autoclitic responses can be classified as autoclitic tacts or autoclitic mands (Peterson, 1978). Autoclitic tacts involve tacts of some nonverbal aspect of the primary controlling relation, while autoclitic mands involve responses controlled by EOs which are emitted because the value of a particular reaction to the primary response is strong. For example, saying *I'm sure it's a moose* may involve an autoclitic mand to get the camera, rather than a tact of the strength of the controlling relation between the nonverbal stimulus and the primary response.

With facilitated communication, autoclitic behavior would be impossible if the student was not the genuine author of the primary verbal behavior. However, if the student was the author, autoclitic mands and tacts could occur in much the same

way as other topography-based systems. They would be limited by the same variables that limit the development of the primary responses with FC, such as a slow and complex response form, and the limited opportunity to emit the verbal behavior in the natural environment.

The receptive repertoires. Receptive discriminations involve a verbal stimulus (usually a mand by a speaker) which evokes a nonverbal response by the listener. Touching the door when asked to is an example of receptive behavior. Receptive language training with FC users is typically not conducted using the same response form that the student uses for emitting verbal behavior. Rather, receptive discriminations are accomplished in the same manner as with speaking persons. That is, vocal stimuli are used to evoke nonverbal responses. This complication would seem to have some effect on verbal development and the formation of functional equivalence relations. However, the blending of spoken and written English may be effective in advancing a student's receptive repertoires with FC, but this question is an issue for empirical research.

If one were to use the codic repertoires of FC in receptive discriminations, which is unlikely, a textual stimulus must evoke a textual response prior to the nonverbal response. For example, in order to correctly respond to the instruction to touch the door the written word *door* must evoke a textual response which in turn must evoke the nonverbal behavior. With speech, the vocal stimulus alone evokes the nonverbal response. This multiple response requirement with FC makes receptive discriminations somewhat more cumbersome. Therefore, training on receptive discriminations with FC are not typically conducted in the student's primary response form.

Why the Controversy Over Facilitated Communication?

There are several possible reasons for the current controversy over FC. First, there are undoubtedly some DD persons who are literate and/or fast learners, and may benefit from this method of communication. Some of these literate individuals may be nonvocal from birth or elective mutes, but may show some immediate and relatively high level verbal skills given facilitation. It is also possible that the significant change in the reinforecment schedule available for these students while engaged in FC, along with some careful 1-to-1 shaping, may be sufficient to evoke (or rapidly develop) mands, tacts, intraverbals, and autoclitics. It is not uncommon to find previously nonverbal students who, when given instruction, have demonstrated a surprisingly rapid acquisition of textual and transcriptive behaviors, but continue to show little or no improvement in speech.

Second, many of the facilitators truly believe that they are not helping the students respond, but are only providing emotional support. Hall (1993) has pointed out, how in many cases, facilitators may be engaging in automatic verbal behavior (i.e, verbal behavior in which the self-editing process has been suspended), and fail to notice that they are the producing the typed message. It certainly is possible that the facilitators are unable to tact their own involvement in the facilitation process. For example, the facilitators at the O. D. Heck Center on the Frontline Program on PBS, were surprised at the results of the research that demonstrated the critical role they played in providing correct responses. Wheeler et al. (1993) have included an appendix in their paper to warn researchers about the devastating emotional effects on facilitators upon finding that it is the facilitators who are emitting the verbal behavior. These examples clearly demonstrate that many facilitators are probably unaware of the role that they play in the communication process.

A third reason for the controversy is that many of the supporters of FC assume that cognitive abilities exist, and that FC simply allows access to these cognitions (Biklen, 1990). This cognitive theory proposes that verbal behavior is already strong in the cognitive processing system, but due to global apraxia cannot be emitted. The observation of high level verbal behavior

during FC seems to support this theory, while drawing attention away from the facilitator's behavior.

A fourth issue that has caused many to try FC is the general hope that it will work. Many parents and professionals are looking for quick cure for DD individuals. Like many "miracle cures" before it, FC seems to provide that hope to many. This hope, like the belief in cognitions, often precludes observers from looking for the true source of the verbal behavior.

Finally, there is a general lack of understanding of the complexity of the issues related to training verbal behavior to nonverbal persons (Sundberg, 1990). Knowing where or how to start language intervention programs for nonverbal individuals is often difficult. Especially for nonverbal adults who may demonstrate high levels of receptive and other nonverbal behaviors. It is often tempting to start expressive language training at relatively high verbal levels, rather than at basic mand, tact, and intraverbal levels. When the training fails to generate expressive verbal behavior, other factors are blamed (which is often why many individuals are still nonverbal as adults). FC, and its premise that these verbal behaviors exist at the cognitive level, seems to conveniently sidestep all of the work and problems involved in teaching an early verbal repertoire. However, given the evidence which points to the facilitator as the speaker (e.g., Green & Shane, 1993), and the conceptual barriers of FC which highly restrict verbal development, FC is probably not a response form that will benefit many nonverbal individuals.

Alternatives to Speech, Transcription, and FC

Pointing systems and sign language are the two major alternatives to speech, independent transcription, and facilitated communication. There is an extensive body of research on each of these two methods of augmentative communication (for reviews, see Fristoe & Lloyd, 1977; Shafer, 1993; Zangari et al., in press). However, there is very little research which directly compares pointing systems and sign language (Shafer, 1993). The research that does exist suggests that there are several practical and conceptual differences between these two types of verbal behavior. These differences may have significant implications for the procedures used to establish verbal behavior for nonverbal students (e.g., Hodges & Schwethelm, 1984; Michael, 1985; Sundberg & Sundberg, 1990; Wraikat, Sundberg, & Michael, 1991). Further identification and clarification of these differences may help parents, teachers, and other professionals decide which system is most appropriate for an individual, and what special intervention techniques may be required to establish, develop, and maintain effective verbal behaviors.

Perhaps one of the most important distinctions between these two types of response forms is the one Michael (1985) makes between stimulus selection-based verbal behavior and topography-based verbal behavior. In selection-based verbal behavior, the response form consists of selecting a stimulus from an array of stimuli by scanning, then pointing to the desired stimulus. The response form of scanning and pointing consists of a multiple response that has essentially the same topography for all verbal relations; what is different is the *stimulus* selected.

Selection-based verbal behavior can be contrasted with topography-based verbal behavior where the *topography* of the response, rather than a selected stimulus, is the distinguishing part of the verbal relation. Speech, writing, and sign language all constitute topography-based verbal behavior because there is a different response topography for each controlling variable. For example, there is a specific sign or word for *shoe* which involves different muscle movements than the sign or word for *hat*, while pointing to a symbol for *shoe* involves basically the same muscle movements as pointing to a symbol for *hat*. The differences between these two types of verbal behavior will be further identified in the form of the advantages and disadvantages of each system, and by an analysis of each system using the concepts from Skinner's (1957) analysis of verbal behavior.

POINTING SYSTEMS (INCLUDING COMPUTER SYSTEMS)

Pointing to (or touching, looking at, etc.) pictures, symbols, or the keyboards of computer-operated devices that electronically produce verbal stimuli, has proven to be an effective verbal response form for previously nonverbal students (e.g., Hurlbut, Iwata, & Green, 1982; McNaughton, 1976; Mirenda, 1985; Reichle, York, & Sigafoos, 1991; Romski & Sevcik, 1988; Shafer, 1993; Vanderheiden & Lloyd, 1986; Zangari et al., in press). There are several advantages of a pointing system which make it an attractive form of augmentative communication. In fact, it is currently the most preferred system to use by language intervention specialists (Shafer, 1993). However, there are several disadvantages which must be considered as well. Both the advantages and disadvantages of pointing systems will now be presented (Table 2).

Table 2
The advantages and disadvantages of pointing systems.

Advantages of Pointing Systems
The listener does not need special training, the English word typically accompanies the symbol or picture
The first responses involve simple matching-to-sample which may be easy to acquire
There is no special shaping of individual response forms, scanning and pointing are about the same for each verbal relation, and it is much easier than shaping the individual responses required for speech or sign
Pointing at stimuli may avoid any negative emotional history associated with speech
The response of pointing may already be strong in the person's repertoire
Disadvantages of Pointing Systems
Pointing at stimuli requires environmental support, the speaker must have the stimuli available to emit verbal behavior, therefore, the student cannot always emit verbal behavior when EOs and S^Ds are strong in the natural environment
The symbols and pictures become increasingly abstract as the complexity as the words increase, and there are space limitations on the boards
The pointer needs to have the listener in close proximity (speech and signs can be successful across a room)
The response is slow compared to speech and sign, and the controlling variables and listener's attention can be easily lost
Pointing systems constitute stimulus selection-based verbal behavior and may be more difficult to acquire; the response form involves a complex type of verbal behavior consisting of conditional discriminations (two or more controlling variables), and a multiple-component response form (scan and point)
There is no point-to-point correspondence between the response and the response product, this correspondence facilitates the acquisition of verbal behavior with self-feedback
There is not an existing or natural verbal community which uses pointing systems as a form of verbal behavior; trainers tend not to use pointing systems to interact with the students, rather English is used
Typically there is no improvement in speech
With pointing systems it is harder to establish functional equivalence

Advantages of Pointing Systems

Perhaps the primary advantage of pointing systems is that the listener does not need any special training. Most symbols have the English word written on them, which means the response can be emitted in the presence of any attentive and literate listener. In addition, many of the first symbols or pictures are easy to acquire because they consist of simple matching-to-sample. For example, the symbol for *ball* or *cup* may look very much like a real ball or cup, and many students who are nonverbal can easily match similar stimuli (Keogh & Reichle, 1985). This matching-to-sample repertoire may facilitate the early acquisition of pointing, much in the same way that a strong echoic repertoire can facilitate speaking, and a strong imitative repertoire can facilitate signing (Sundberg, 1990).

Another advantage of pointing systems is that the response topography (pointing) is the same for each verbal operant, so training differential responding is not necessary. This feature makes this form of response especially effective for individuals with muscle control problems such as those with CP and TBI. Also, there has been substantial progress in the technological development of communication devices, computers, and software which is greatly improving the efficiency of this form of verbal behavior (e.g., Zangari et al., in press). These developments may pro-

vide some solutions to the disadvantages of pointing systems identified below.

Disadvantages of Pointing Systems

Unfortunately, there are several practical and conceptual limitations with pointing systems that may impede verbal development. These limitations should be considered before designing a language intervention program for a nonverbal student. Perhaps one of the most significant practical barriers with pointing systems is that, like with writing, typing, and FC, responding is dependent on environmental support. This presents practical limitations because, unlike speech and sign language, the response form is dependent on other stimuli and cannot be emitted when those stimuli are absent. For example, to successfully mand with a pointing system the board must be present. If the board is not available, the response cannot occur. This type of constraint is significant because verbal behavior may be impossible to emit when EOs and S^Ds are strong in the natural environment. These conditions may also evoke negative behavior such as tantrumming or SIB, because these behaviors may be the only response form available to the individual.

Many other practical limitations of pointing systems have been identified in the literature (e.g., Shafer, 1993; Sisson & Barrett, 1983; Sundberg & Sundberg, 1990; Wraikat et al., 1990). Some of these limitations include the difficulties of portraying complex words in symbol form, the space limitation of most boards, and the need to always have the listener in close proximity (speaking and signing can be successful even when a listener is across the room). Also, the response of pointing to stimuli is naturally slower than speaking (or signing) because of the required time to scan the array of stimuli to find the appropriate stimulus. However, these problems could be overcome with substantial training and utilization of the many new technological developments in presenting and arranging stimuli. Lana the chimpanzee (Rumbaugh, 1977), for example, acquired a very rapid rate of verbal responding, using an easily accessible computer-operated response board, strong reinforcers, and careful shaping.

The conceptual limitations of pointing systems are more problematic. A major disadvantage of a selection-based form of verbal behavior is that the response form of scanning and pointing is a multiple-component response, rather than a single-component response like that of speaking and signing. Also, unlike speech and sign language, the controlling variables constitute conditional discriminations in that the presentation of stimulus or establishing operation (e.g., a cup), alters the evocative effect of a second stimulus (the appropriate symbol for *cup* or *drink*). Therefore, effective responding with a selection-based system always involves two or more controlling variables and a two-component response. These unique features of selection-based systems make teaching this type of verbal behavior more complicated (Michael, 1985; Shafer, 1993; Sundberg & Sundberg, 1990; Wraikat et al., 1991).

Another limitation with pointing systems is the absence of a functioning verbal community that uses these systems to communicate. Students who learn to use pointing systems typically do so without the advantages of observing competent speakers engage in verbal interactions by pointing. Also, students do not have opportunities to observe competent speakers using more advanced symbols from the communication system. Rarely is it the case that adults (e.g., teachers, parents, staff) use symbol boards to communicate with each other, nor do they regularly use the boards when verbally interacting with the students; they typically use spoken English. This lack of contact with models in the natural environment would seem to make language acquisition more difficult, especially given the fact that exposure to a fluent verbal community is essential for the development of the verbal repertoires (Skinner, 1957).

A final issue about symbol systems concerns the effects of learning to point on the development of vocal behavior. In their review of the literature on pointing sys-

tems, Sisson and Barrett (1983) note that none of the studies mention vocal behavior or vocal improvement. This lack of vocal improvement may be due to the fact that with pointing there is not a differential response form which can get paired with a specific word. That is, the same pointing response is associated with all words. While it seems plausible that vocalizations could improve due to the effects of successful verbal interaction, the degree of improvement may be small.

The Picture-Exchange Communication System

The Picture-Exchange Communication System (Bondy & Frost, 1993) is a unique type of verbal behavior where a student scans, selects and hands a picture to a listener as a form of verbal behavior. This type of selection-based verbal behavior differs somewhat from the other types discussed above. It does involve the scanning and selecting of specific stimuli and a multiple-component response, but the exchange aspect involves some important features which may facilitate the acquisition of verbal behavior. Specifically, the exchange requires that the adult interact with the response form (i.e., they must receive the picture). This makes it easier for the adult to function as a speaker and a listener in the language system. The pictures may become conditioned reinforcers more easily, and functional equivalence relations may form quicker. This mitigates the problem of the adult not using the symbol board. In addition, it may be that this system avoids the problem of weak echoic or imitation skills, and avoids any negative histories often associated with attempts to speak or sign. Finally, it appears that there is a reported effect on vocal behavior (Bondy, personal communication). Future research on this system should prove interesting.

An Analysis of Pointing Systems Using the Concepts from Skinner's Book Verbal Behavior

There are several aspects of a pointing system, and stimulus selection-based systems in general, which impede the natural shaping of the verbal operants. Perhaps the main barriers are the dependence on environmental support, the complexity of the stimuli and responses involved, the lack of a natural verbal community, the slow rate of responding, and the difficulty of portraying complex words in symbol or picture form. Below is an analysis of how these barriers will affect the development of each of the elementary verbal operants, as well as the development of the autoclitic and receptive repertoires.

The mand repertoires. Pointing systems suffer from the same problem identified for FC in that the emission of a response depends on environmental support. When EOs occur in the natural environment the student often may not have immediate access to the board or computer. This situation is common for many users of pointing systems who are very mobile (e.g., autistic children), or find carrying a communication device (or board) cumbersome or aversive. The occurrence of EOs in the natural environment cannot produce manding by pointing to a stimulus, so negative behaviors (e.g., screaming) may occur as mands. In addition, the loss of the opportunity to emit the trained verbal responses under the control of EOs in the natural environment severely limits teaching opportunities (e.g., Hart & Risley, 1975) and verbal development (Michael, 1988, 1993). It may be difficult, for example, to teach complex mands such as asking questions. These problems may not be as serious for students who are wheelchair bound. However, even these students are frequently in situations where they will be unable to mand when EOs are strong (e.g., in bed, on the toilet, on the floor mat).

These problems can be overcome somewhat by ensuring that the board is always available to the student, or devising a system that is highly portable. Picture wallets and picture necklaces have been used successfully for some clients, but the number of the responses available are limited, and the rate of emitting a verbal response containing several components will be slow. This is a problem because if the response is too slow, the temporal contiguity between specific antecedents, behavior, and conse-

quences will be broken (i.e., searching for the right stimulus takes time and the original controlling variables or the listener's attention can be lost, also the consequences may become too delayed).

The tact repertoires. Tacting would probably be the least affected by the unique nature of selection-based verbal behavior. Nonverbal stimuli can easily be presented and responding can be prompted, shaped, and differentially reinforced. However, as the nonverbal stimuli become more complex it becomes increasingly difficult to present these stimuli pictorially or symbolically. This complexity may require more training trials than a similar verbal operant using a topography-based system (Sundberg & Sundberg, 1990; Wraikat et al., 1991). In addition, the number of responses available may be limited due to space requirements, and the length of the response may be short due to time and response effort requirements.

The intraverbal repertoires. There are several general difficulties in establishing an intraverbal repertoire with pointing systems. First, the lack of a natural verbal community means that the symbols are not systematically paired with adults and strong reinforcers in the manner that speech is paired with such reinforcers. Much of a speaking child's intraverbal behavior is affected by regular exposure to a highly reinforcing natural verbal community. Intraverbal connections (e.g., strings of words, songs, phrases) are often paired with powerful reinforcers such as food, attention, and physical contact. As a result, words become automatically reinforcing to emit because the response products (sensory feedback or what you hear, see or feel when verbally responding) have reinforcing properties and as a result have functional control as a consequence (Vaughan & Michael, 1982; Skinner, 1957; Sundberg, Sundberg, & Partington, 1993). There is a self-shaping process where the response becomes stronger each time it is emitted because the response is automatically reinforced. This effect may not occur if reinforcing adults do not use the symbols to verbally interact with the student.

A second complication in developing the intraverbal repertoire with pointing systems involves the presentation of verbal stimuli. In order to be consistent with the established response form of pointing, pictures or symbols would need to be presented as verbal stimuli, and training would involve establishing intraverbal connections between one picture and another. This repertoire would require special training procedures and symbols to establish. For example, a trainer could point to a general symbol for *food* and establish pointing to a number of the symbols for specific foods. Or, when asking about a field trip, a trainer could point out the symbols *What did you see on your trip?* However, this type of intraverbal presentation is not typical. Instead trainers usually ask the question in spoken English which requires an additional intraverbal relation be established (i.e., English and pointing). It is unclear what effect this might have on intraverbal development, but it is not uncommon to see pointing system users who are unable to emit a substantial amount of intraverbal behavior. (However, the same point could be made for all of the forms of augmentative communication. The real problem is that intraverbal behavior is typically not systematically targeted for intervention.)

The codic repertoires. It is certainly possible that the written word which is paired with the symbol may eventually be able to demonstrate control over the response. However, if English words did come to evoke pointing to specific stimuli the relation would actually be intraverbal because of the lack of point-to-point correspondence between the verbal stimulus and the verbal response (Skinner, 1957). Thus, it would be impossible to have true codic behavior with pointing, unless it involved pointing to letters to spell out words.

The autoclitic repertoires. The lack of a functioning verbal community in the natural environment, that models and reinforces autoclitic behavior by pointing to stimuli, would seem to have an effect on a student's autoclitic development. However, most of the autoclitic functions could

be accomplished with a pointing system, but would require special training procedures. The responses would probably be slower due to the general complexities of emitting primary responses, and it may be difficult to differentially establish symbols for some of the rather complex autoclitic responses.

The receptive repertoires. Receptive language with pointing systems is often hard to distinguish from intraverbal behavior. A truly receptive response with pointing systems would be, for example, touching a specific object given the presentation of the associated symbol. However, receptive training is typically not systematically provided in this way. Rather, spoken words are used as S^Ds to touch specific symbols (e.g., "Show me *car*"), probably because many students already have a number of behaviors under receptive stimulus control using spoken words (often receptive trials occur in the absence of the board). Therefore, it is probably the case that most of what is assumed to be receptive discrimination trials between words and pointing to symbols or pictures is probably intraverbal rather than receptive, because the stimulus and the response are both verbal and lack point-to-point correspondence. On the other hand, what is thought to be intraverbal may actually be receptive, it depends on the verbal or nonverbal properties of the stimuli involved. In any case, it is cumbersome to conduct receptive trials consistent with the response form of pointing, so English is typically used instead.

In conclusion, it appears that there are many disadvantages of a pointing system, including several restrictions on the development of the verbal operants. For some individuals there may be no alternatives, but for others sign language may be worth considering. An analysis of the advantages and disadvantages of sign language, followed by an analysis of sign language and the acquisition of the verbal operants, will now be presented.

SIGN LANGUAGE

The use of sign language with nonverbal persons has also proven to be an effective way to generate verbal behavior. There are now several studies in the literature which demonstrate that a wide variety of nonverbal people can acquire sign language (e.g., Bonvillian, Nelson, & Rhyne, 1981; Carr, 1979; Clarke, Remington, & Light, 1986; Fristoe & Lloyd, 1977; Partington et al., in press; Reichle, York, & Sigafoos, 1991). Sign language has many advantages as a response form and only a few disadvantages (Table 3).

The Advantages of Sign Language

Sign language is a very efficient form of verbal behavior and has many of the same advantages as speech. Sign language constitutes a topography-based language, so it like speech, benefits from a differential response form that is independent from the physical environment. Signs are completely portable so verbal behavior can be emitted under all potential types of controlling variables. Also, the deaf population provides a natural verbal community

Table 3
The advantages and disadvantages of sign language.

Advantages of Sign Language
Sign language constitutes topography-based verbal behavior that is free from environmental support, making it portable and conceptually similar to speech
The deaf community constitutes a natural verbal community that uses sign language, so materials and trainers are available
The response form (imitation) may already be strong in the person's repertoire
Trainers can use and fade physical prompts to obtain the response form
The stimulus and the response often resemble each other (an iconic relation) providing a built-in prompt
Sign language can improve speech
Sign language involves a single response and a simple discrimination
The response and response product have point-to-point correspondence
Sign language may avoid the negative emotional history involved with speech
Disadvantages of Sign Language
The listener must have special training, and there is a need to establish a signing verbal community
The trainer must shape individual responses

where sign language is the primary response form. This makes sign language a living language in the sense that it is still growing, changing, and affecting and being affected by, a community of listeners and speakers. This also ensures a variety of materials, teachers and trainers, videos, research, and other auxiliary support items necessary for teaching verbal behavior to nonverbal persons may be available.

Sign language has several specific advantages over speech, and the other types of augmentative communication which may mitigate the disadvantages identified below. Sign language training may be easier than speech training because many DD persons who cannot echo sounds, can emit motor responses under imitative control. These responses can quickly be brought under EO, nonverbal, and verbal control while fading out the imitative control, thus the establishment of a multiply controlled mand (Sundberg, 1990). For example, under many circumstances it may be easier to teach a student the sign for *drink,* than it would be to teach the vocal word *drink,* or to teach the student to reliability point to the symbol for *drink.*

If a student does not have a strong imitative or echoic repertoire it will probably be easier to teach him to imitate a motor movement than to echo a word, because of the advantage of physical prompting and fading procedures. For imitative training, the student's hands can be physically guided by the teacher to the appropriate position and then the physical prompts can be faded out. This physical prompting procedure is impossible with the vocal musculature since one cannot directly manipulate the parts of the vocal system to produce specific sounds. The use of physical prompting may make the shaping easier, while also providing clear and unambiguous models of the appropriate response form.

Sign language also benefits from the fact that many of the signed response forms closely resemble the controlling variables in the environment. The sign *ball* for example, is made by placing the curved finger tips of both hands together out in front of the body. The sign looks like a ball made with the hands. The iconic relation between controlling variables and appropriate responses may make sign acquisition easier than vocal response acquisition. Spoken English has only a few of these iconic, or onomatopoetic relations (e.g., "hum," "bow wow," "buzz"), and they are of little help in early language acquisition.

Finally, there are several ways in which sign language may facilitate the establishment of vocal response forms and improve language acquisition in general. First, sign language may solve the immediate problem of not being able to verbally interact with others. Signs allow the listeners (e.g., parents, teachers, peers) to immediately understand what the person might be trying to say, thereby permitting the delivery of the specific reinforcement necessary to reduce the evocative effect of the EO. In addition, this successful verbal interaction provides an excellent opportunity to shape articulation. These points could be made for all types of augmentative communication, but sign language, as a topography-based system free from environmental support, has some unique features which may result in substantial vocal improvement.

First, if trainers speak as they sign, and require and reinforce approximations to spoken words, specific words can become differentially associated with specific signs and highly reinforcing verbal interactions (e.g., successful manding). Therefore, not only might specific speech sounds become paired with specific signs, but specific sounds may also become conditioned reinforcers, and even automatic reinforcers as well. These new forms of reinforcement can strengthen vocal behavior in many ways (e.g., Skinner, 1957; Sundberg et al., 1993). For example, in mand training if the spoken word *eat* is consistently paired with the sign *eat* and the delivery of food, the spoken word *eat* may acquire new evocative and reinforcing effects (Michael, 1983). As a result, the spoken word *eat* may also enter into a number of different functional equivalence relations such as those where vocal stimuli control signing and receptive

responding (Hall & Chase, 1991; Sundberg & Sundberg, 1991). Also, the establishment of echoic stimulus control, and other types of verbal behavior involving vocal behavior, may now be easier, especially if vocal behavior already occurs to some degree (Clarke, Remington, & Light, 1988). It is also possible that the successful establishment of a generalized imitative repertoire (which is typical for many accomplished signers), may facilitate echoic behavior.

Sign language may improve articulation for a number of other reasons as well. If signs begin to evoke specific vocalizations, then signs can be used as a new type of prompt to evoke these vocalizations. This type of prompting may be more effective than typical echoic prompts which provide the response form, making it harder to transfer control to the other types of verbal behavior. Also, students learn to sequence motor movements which are often easier to sequence than vocal movements. Once the motor movements are learned, specific vocalizations can be matched with the signs. This sign-vocalization prompt can help in other ways as well. A student can use signs to prompt his own vocalizations. That is, if a nonverbal stimulus can evoke a sign, and a student is able to emit a vocalization under the control of a sign, then he can self-prompt his own vocalizations. For example, when a signing student wants a cup, but there is not one present, the sign *cup* can prompt the articulation of the word *cup*. This self-prompting may result in more successful vocal-verbal interactions and less punishment for attempts to speak.

The Disadvantages of Sign Language

The primary disadvantage of sign language is that the listeners must learn and use sign language to function as an effective verbal community. Learning to sign may involve a substantial commitment to attend classes and practice sessions (like other second languages). Also, a signing environment must be established where signs are consistently reinforced, and models of signing are frequently provided and paired with other forms of reinforcement. The establishment of this verbal community is essential for verbal development (Skinner, 1957; Sundberg, Milani, & Partington, 1977), but these barriers may be difficult to overcome because of the lack of available training and resources, and frequent staff turnover. However, it should be pointed out that even a small signing repertoire on the part of trainers may be sufficient to begin sign training.

Sign language has other disadvantages as well. First, since sign language is a topography-based system each response form (sign) must be individually shaped (unless the individual has acquired a generalized imitative repertoire). This requires that staff have special training in shaping, prompting and fading, and in differential reinforcement procedures. Pointing to stimuli and FC responding eliminate this problem (but at a later cost) by using the same behavior for all verbal operants and physically prompting the response form, respectively. The use of sign language also requires different training procedures than those used with speech and pointing systems. For example, physical and imitative prompts can be used along with echoic and intraverbal prompts. These training methods may require extra effort to learn.

An Analysis of Sign Language Using the Concepts From Skinner's Book Verbal Behavior

Sign language is functionally closer to speech than the other two types of augmentative communication (Table 4). This is primarily because sign language constitutes a topography-based verbal system that is free from environmental support. As a result, the acquisition of the verbal operants using sign language as a response form is similar to the acquisition of the verbal operants using speech as a response form. Sign language development seems to parallel speech development in every way, providing there exists a consistent reinforcing verbal community. Data show that when a deaf child is raised by deaf parents who sign, the child acquires verbal behavior similarly to a hearing child raised by speaking parents (Moores, 1978; Vernon & Koh, 1970; Zwiebal, 1987). Therefore, if the

Table 4
Comparing the response forms by the potential strength of the verbal operants.

	Speech	Facilitated Communication	Pointing Systems	Sign Language
Mand	Strong	Weak	Weak-Medium	Strong
Tact	Strong	Weak-Medium	Medium	Strong
Intraverbal	Strong	Medium	Weak	Strong
Codic	Strong	Strong	Weak	Weak-Medium
Autoclitic	Strong	Weak-Medium	Weak-Medium	Strong
Receptive	Strong	None (Speech)	None (Speech)	Strong

critical people in a signing person's environment do not acquire sign language, then the probability is low that the verbal repertoires will develop properly.

The mand repertoires. Signs can be equally effective for manding as speech, provided the people in the student's environment use and reinforce sign language.

The tact repertoires. Tacting in sign language differs in no significant way from tacting with speech. The key issue is again, is the presence of a reinforcing signing verbal community.

The intraverbal repertoires. The establishment of sophisticated intraverbal behavior primarily depends on contact with a signing verbal community. Limited exposure to signing models and audiences will make it difficult to establish complex intraverbal behavior. However, with a signing verbal community, the development of signed intraverbal behavior can parallel that of spoken intraverbal behavior.

The codic repertoires. Since there is no point-to-point correspondence between signs and letters, it is unlikely that codic behaviors would occur via signing (this would require speaking, or fingerspelling). However, intraverbal relations between written words and signs can occur (like with pointing systems) providing students with a form of literacy.

The autoclitic repertoires. Autoclitic development with sign language also differs in no significant way from speech. Secondary mands and tacts can be acquired, given a reinforcing verbal community.

The receptive repertoires. Responding to a signed verbal stimulus does not differ conceptually from responding to a spoken verbal stimulus. Therefore, all forms of receptive behavior are possible with sign language, given a reinforcing verbal community.

In conclusion, sign language has several advantages that make it an appealing alternative response form. Especially attractive is the fact that it is a topography-based system that is free from environmental support. In addition, verbal development with sign language appears to closely parallel verbal development with speech, while this is not the case with the other response forms (Table 4). However, the major disadvantage of sign language is the requirement that the trainers, and other persons in the student's environment, learn to sign. Deciding which augmentative system might be the most appropriate for a specific individual will now be discussed.

SELECTING A RESPONSE FORM

Speech is the response form of choice. Effort should always be given to developing vocal verbal behavior prior to considering an augmentative system. Particular procedures like mand training and automatic reinforcement pairings may substantially improve vocal behavior, as might a number of other proven speech therapy techniques. In considering speech as a viable response form, one should assess the strength of the person's echoic repertoire. If echoic behavior is moderate or strong, then a vocal response form should

be pursued. Even a very small amount of echoic behavior may be enough to immediately get started with vocal mand training. If repeated attempts to establish vocal verbal behavior as mands or tacts fail, then an augmentative system should be considered.

Given the three alternative response forms available for nonverbal individuals, how does one decide which system is most appropriate for a specific individual? First, one must consider the individual and his disabling condition. If the nonverbal person is severely physically involved such as those with CP and TBI, the differential muscle control necessary for speaking, signing, or writing may be impossible. For these individuals a pointing system or FC may be the only options. However, in order to use FC as the genuine speaker, the person would have to be able to demonstrate literacy. Typing and spelling could conceivably be taught through facilitation, but it would seem to take a large number of training trials. In addition, the possibility of automatic verbal behavior on the part of the facilitator would have to be ruled out, which would be difficult because it occurs so readily (Hall, 1993). Even if the person is literate, the facilitator could still engage in automatic verbal behavior and control some of the typed messages.

If the nonverbal person is literate, then independent writing or typing may be a reasonable response form to use, especially if echoic and imitative behaviors are weak. Typically, the existence of these verbal operants is accompanied by related mands, tacts, and intraverbals, however, for some individuals the other operants might be quite weak. It is not unreasonable to use the transcriptive mode to establish or further develop these other verbal operants. This may even be possible with facilitation, through an arduous shaping process. But in some cases (e.g., CP and TBI), it is certainly possible that independent verbal operants could be acquired easier, or be further developed with facilitation. However, if the person is not literate, or does not have pre-existing verbal operants, then FC as a response form will probably not be effective.

When considering a system for nonverbal students who are not literate, nor severely physically involved (e.g., most DD individuals, autistic children), the primary choice is between pointing systems and sign language. Given the many advantages of sign language as a topography-based system which parallels and possibly improves speech, and the many disadvantages of pointing systems as a selection-based system requiring environmental support, sign language should be the response form of choice. However, it may be the case that individual differences or histories favor one system over another. In addition, it is possible that a blend of different systems may be beneficial for some individuals (Shafer, 1993), especially as they become older and need a method to communicate with untrained audiences.

However, the current trend is to favor pointing systems over sign language (Shafer, 1993), primarily because it is easier for the listener to understand what is being pointed to by simply looking at the picture, symbol or written word touched. Sign language requires that the listener receive special training to effectively react as a listener. This practice may be supported by cognitive theory which focus on what words mean to listeners, thereby placing the emphasis on listener behavior rather than on speaker behavior (Skinner, 1957). This emphasis on the listener would favor pointing systems over sign language because of the readily available supply of listeners. Therefore, from this point of view it would not be unreasonable to assume that pointing would be easier to acquire and more functional than sign language. However, behavioral conceptual analyses (Michael, 1985; Shafer, 1993) and empirical analyses show that not only are signs closer to speech, but when all things are equal, sign language is easier for a student to acquire than pointing at stimuli (Sundberg & Sundberg, 1990; Wraikat et al., 1991).

In conclusion, systems of augmentative communication have played a major role

in the development of successful verbal skills for nonverbal individuals. The decision as to which type of augmentative system to use is often complicated by an individual's specific needs and the general complexities of the options available. Sign language is conceptually closest to speech and has the most advantages and fewest disadvantages of the various options presented, with pointing systems being the next most preferred. Finally, it is clear that only a small number of nonverbal persons could benefit from facilitated communication.

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