Assessing Stimulus Preferences and Testing Stimuli as Reinforcers for Children and Adults with Profound Mental Retardation and Multiple Disabilities

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by

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Abstract

It is essential in the development of a successful training program for persons with profound mental retardation and multiple disabilities (PMD) to use effective reinforcers. During several experiments, a single-stimulus (SS) preference assessment has been used to identify preferred stimuli that might be reinforcers with individuals with PMD. With this method, the activities or stimuli that are being assessed are presented individually to a client. The client has a limited period of time in which to respond, and an appropriate response is followed by the opportunity to interact with the stimulus for a short time. Each stimulus is typically presented a certain number of times (e.g., 10 trials), and a high preference (HP) item is defined as a stimulus that the client responded to on 80% or more of the trials. However, there have been some discrepancies in the literature about how the SS procedure has been conducted. Some researchers have defined the preference response as a physical approach toward a presented stimulus, while others have accepted either an approach response or happiness indicators. As well, some researchers allow a participant 5 s after the stimulus has been presented to indicate a preference, while others have allowed 30 s. Each of these variations in the SS procedure may lead to different results in identifying preferred stimuli and reinforcers for these individuals. My research investigated these methodological variations to determine which was the most effective method to identify highly preferred non-edible stimuli and reinforcers for individuals with PMD. Also, I compared the SS preference assessment method for identifying preferred stimuli and reinforcers to the opinions of experienced teachers or caregivers who were familiar with each of the participants.

In Experiment 1, I studied eight participants with PMD, and investigated which preference assessment response (approach behaviors versus approach and/or happiness behaviors) was the most sensitive in identifying preferred stimuli and reinforcers. The design

was an ABAB design. The A phases were an SS preference assessment in which the preference response was defined as an approach behavior, in order to determine which of six stimuli was the most highly preferred. The HP stimulus was then tested for its reinforcing value in maintaining the pressing of a micro-switch. The B phases were the same as the A phases, except that the preference response was defined as approach and/or happiness behaviors. For some of the participants, the phases were reversed (BABA). The two response definitions were approximately equal in identifying HP stimuli and reinforcers.

In Experiment 2 I studied 8 participants with PMD (3 of whom were new, and 5 of whom had previously participated in Experiment 1) and investigated which response interval (5 s versus 30 s) was the most effective in identifying preferred stimuli and reinforcers. The approach only preference response from Experiment 1 was used. Like Experiment 1, the design was an ABAB design, in which half of the participants received the conditions in the reverse order (BABA). During the A phases, the SS preference assessment allowed each participant 5 s to emit the preference response. The B phases were the same as the A phases, except that the participant was allowed 30 s to emit the preference response. The HP stimuli were then tested for their reinforcing value. The 30s response interval was superior to the 5s interval in identifying reinforcers. In both experiments, there was no correlation between caregivers' rankings of the stimuli and whether they were reinforcers for the participants. Identifying the most effective preference assessment method is important, because it allows us to identify reinforcers for teaching programs, and to increase the quality of life for individuals with PMD.

Introduction

A serious challenge for clinicians and researchers working with persons with profound mental retardation and multiple disabilities (PMD) has been to provide appropriate educational and habilitative programs that contribute to a satisfactory quality of life (Green & Reid, 1999; Ivancic & Helsel, 1998; Reid, Phillips, & Green, 1991). A recommended component of educational programs is to conduct a preference assessment to discover stimuli that an individual prefers or does not prefer (Green et al., 1988). Highly preferred items can then be used to increase the enjoyment that these individuals experience in their daily lives, which is assumed to increase their quality of life. Additionally, highly preferred items may act as reinforcers in teaching programs, and our current teaching technology is based largely on providing reinforcement for desired behaviors, while not reinforcing undesired behaviors (Ivancic, 2000). Conversely, non-preferred items can be removed from their programs, in order to decrease some of the unhappiness that they may experience. However, for persons with PMD, it is difficult to identify stimuli that are preferred, and that will function as reinforcers for teaching tasks (Ivancic & Bailey, 1996; Logan & Gast, 2001; Reid et al., 1991). This research included two experiments to examine methods for identifying highly preferred stimuli and reinforcers for children and adults with PMD.

Behavioral Characteristics of Persons with PMD

It has been estimated that approximately 1% of the general population has been diagnosed with Mental Retardation (MR; American Psychological Association [APA], 1994). MR is defined as consisting of significantly less than average intellectual functioning (IQ of less than 70), and deficits in adaptive functioning in a number of different domains, including communication, self-care, academic and interpersonal skills. MR is diagnosed using a

standardized intelligence test, where mild MR is an IQ score ranging from 50-55 to ~70, moderate MR is from 35-40 to 50-55, severe MR is from 20-25 to 35-40, and the profound range of MR is an IQ below 20-25 (APA). Approximately 85% of individuals with MR are diagnosed with mild MR, 10% with moderate MR, 3-4% with severe MR, and 1-2% with profound MR (APA).

The category of PMD has been defined as an individual who exhibits "profound mental retardation, physical disabilities that prohibit ambulation, and at least one other type of handicap (e.g., sensory impairment) (p. 321)" (Reid et al., 1991). The proportion of individuals who fall into the category of PMD is a small segment of the profound MR population (Landesman-Dwyer & Sackett, 1978), yet they are very difficult to teach and care for, because of their complete reliance on caregivers for all of their daily needs. While it has been difficult to determine preferences and reinforcers for this population, it should be possible to do so, given the right procedure (Logan & Gast, 2001; Reid et al., 1991). It has been found that these individuals are able to show distinct, individual patterns of stimulus preference and can show clear differences in the amount of time that they will spend interacting with different stimuli (Kennedy & Haring, 1993).

When studying individuals from this population, Reid et al. (1991) made a number of suggestions about factors that may be important in designing programs. They suggested that the amount of controlled body movements that an individual is capable of may be an indicator of the potential for teaching functional skills. An individual's ability to intentionally move may indicate the utility of operant training procedures, as well as give teachers ideas about what behaviors to teach. Ivancic and Bailey (1996) and Ivancic, Barrett, Simonow, and Kimberly (1997) found that some individuals with PMD have very limited movement ability. This may limit their ability to

respond to preference assessment or reinforcer testing procedures.

Reid et al. (1991) suggested that the number of environmental stimuli that an individual will reliably respond to may be another important factor to consider. Also, many individuals in this population have difficulties with their level of alertness and responsiveness to training.

Preference Assessments with Persons with Mental Retardation

Preference assessments have been used for over 20 years with persons with MR as a systematic way of determining individual clients' preferences from among a wide variety of stimuli. An individual's preferences are evaluated by presenting different stimuli to the client and measuring his or her responses to them. Because of the simplicity of the methods used in these assessments, as well as the ease of measuring the dependent variables, a preference assessment is a time efficient way of identifying clients' preferred stimuli or activities (Fisher, Piazza, Bowman, & Amari, 1996). Once an individual's preferences are known, caregivers can provide that client with items that are more likely to be reinforcing. Preference assessment information has been used to increase happiness indicators and quality of life (Green, Gardner & Reid, 1997, Green & Reid, 1996), to decrease the rates of self-injurious behavior (Piazza, Fisher, Hanley, Hilker & Derby, 1996; Ringdahl, Vollmer, Marcus & Roane, 1997; Roane, Lerman, & Vorndran, 2001), and to identify effective reinforcers for teaching programs (Green, et al., 1988; Logan et al., 2001; Mason, McGee, Farmer-Dougan, & Risley, 1989; Pace, Ivancic, Edwards, Iwata, & Page, 1985).

Preference assessments have been found to be more likely to identify high-preference items and reinforcers when compared with caregiver opinion. Three reviews of preference assessment studies with persons with MR (Hughes, Pitkin, & Lorden, 1998; Logan & Gast, 2001; Lohrmann-O'Rourke & Browder, 1998) reported that when preference assessment results

are compared with caregiver opinions on client preferences, there are consistently large differences between the two. Caregiver opinion is considered a useful place to start when identifying stimuli to include in a preference assessment, but opinion alone is less accurate at identifying effective reinforcers than a systematic assessment (Fisher et al., 1996). However, it may be that the lack of agreement in these studies has been due to the staff members' unfamiliarity with the clients' reactions to the stimuli being assessed. Ivancic et al., (1997) pointed out that caregiver opinions were more reliable (closer to the results of the assessment) when they had direct experience with the stimuli that were included in the assessment.

It is important to keep in mind that preference for an item or activity is inferred from the observation that an individual chooses some items more often than others, over repeated choice opportunities. An item that is selected at a higher rate over time is called a preferred item, and is more likely to be a reinforcer for that individual than an item that is rarely chosen (Hughes et al., 1998). Individuals with MR, especially those with severe disabilities and a lack of communication skills, typically have very few opportunities to express preferences or to make choices in their daily lives. A preference assessment can be a way of determining an individual's preferences, so that preferred items can be incorporated into the individual's daily routines.

Methods of Assessing Preferences with Persons with MR

A number of different methods have been developed to assess preferences for persons with MR. One type is a single-stimulus (SS) presentation method. For this method, the activities or stimuli that are being assessed are presented individually to a client. The client has a limited period of time in which to respond, and if he or she demonstrates approach and/or happiness behaviors during that time, then he or she is permitted to fully interact with the stimulus for a short time (e.g. 5 s). Each stimulus is presented a certain number of times (e.g., 10 trials). A high

preference (HP) item is defined as a stimulus that the client displayed an approach response to during 80% or more of the stimulus presentations. A low preference (LP) stimulus is one that was approached on less than 50% of the trials (Green et al., 1988, 1997; Green & Reid, 1996; Green, Reid, Canipe & Gardner, 1991; Ivancic & Bailey, 1996; Logan et al., 2001; Pace et al., 1985). Some studies have recorded a physical movement toward the stimulus, while others have recorded both a physical approach and smiling, and have consequated either response with receiving the stimulus. However, the definition of the preference response may affect the outcome of the assessment, and this consideration will be discussed later.

Most researchers agree that an SS preference assessment is the best method for those with profound disabilities, movement difficulties, poor scanning skills, visual impairments, or who are unable to indicate a choice between two or more items (Fisher et al., 1992; Logan et al., 2001; Pace et al., 1985; Reid et al., 1991). One limitation of this style of preference assessment is that some individuals (especially those who are higher functioning) approach most or all of the stimuli on every trial. This leads to very little differentiation between stimuli and yields many false positives when the stimuli are subsequently tested to see if they function as reinforcers (Fisher et al., 1992; Hagopian, Rush, Lewin, & Long, 2001; Paclawskyj & Vollmer, 1995; Roscoe, Iwata, & Kahng, 1999).

Another way of assessing preferences is with a paired-stimulus (PS) presentation method (Hagopian et al., 2001; Roane et al., 2001; Roscoe et al., 1999). This has also been called a forced-choice (Fisher et al., 1992; Paclawskyj & Vollmer, 1995) or choice assessment (Fisher et al., 1996). In this method of preference assessment, the tester puts two items in front of the participant. When the participant chooses one item, he or she is allowed to interact with it for short period of time. Stimulus pairs are presented until each item has been paired with every

other item at least once, and sometimes several times. The client's preferences are determined by ranking the stimuli according to the number or percent of trials that each was chosen from the number of trials it was available. The HP stimulus is the one that was chosen most often.

Some researchers have found that the PS method is a better predictor of reinforcers than the SS method (Fisher et al., 1992; Hagopian et. al., 2001; Lohrmann-O'Rourke & Browder, 1998). This is because a clear preference hierarchy is often found among the various stimuli when the PS method is used. However, this type of preference assessment takes longer to administer than the other types of assessments.

A third way to conduct a preference assessment is using a multiple-stimulus presentation method. With this method, more than two (typically 6 or 7) items are placed in front of the individual, and he or she must choose one of them. There are two ways of conducting this style of presentation. The first way is called a multiple-stimulus with replacement assessment (MS; DeLeon & Iwata, 1996; Windsor, Piché, & Locke, 1994). With this method, a stimulus array is placed so that the items are arranged in an equally spaced line on a table in front of the participant. He or she is prompted to choose one edible or item, and is then allowed to interact with the item for a short while (or eat it). On the next trial, the same items are arranged in a different order, and the participant is again prompted to choose one item. A number of trials are conducted, and the items are ranked according to the number of times that each was chosen. The item that was selected most often is expected to function as a stronger reinforcer than the lowest-ranked item.

The other way that a multiple-stimulus preference assessment can be conducted involves not replacing the selected items on every trial, called a multiple-stimulus without replacement assessment (MSWO). Typically, 6 or 7 items are arranged just as in the MS presentation, but

once an item is chosen, it is not replaced in the array. The items are rearranged after every trial, and the participant must choose one of the remaining items, until he or she has sampled each one, or refuses to choose any more. Typically, an assessment such as this is conducted several times, and each item is given a rank based on how many times it was chosen first, second, third, and so forth (Bojak & Carr, 1999; Carr, Nicolson, & Higbee, 2000; DeLeon & Iwata, 1996; DeLeon, Iwata, Conners, & Wallace, 1999; Graff & Ciccone, 2002; Higbee, Carr & Harrison, 2000). It has been found that the MSWO assessment method has the same predictive validity as the PS method, and takes less than half the time of the typical PS preference assessment (Lohrmann-O'Rourke & Browder, 1998). Additionally, MSWO assessments where the procedure is repeated three, five, or seven times produce very similar rankings among the items (Graff & Ciccone, 2002).

However, one limitation of this method is that the participant must be able to fully scan the entire array before choosing a stimulus. This is often difficult for individuals with severe mental or physical disabilities, and/or impulsivity problems. For these individuals, the MS or MSWO methods may not reflect the client's actual preferences (Hagopian et al., 2001).

Another method to assess preference is an engagement-based assessment (DeLeon et al., 1999; Hagopian et al., 2001; Piazza, Fisher, Hanley, et al., 1996). This method was developed to avoid the problem of the SS assessments overestimating the reinforcing value of the stimuli, and the undifferentiated results that sometimes occur with the PS and MSWO assessment methods. For this style of preference assessment, a single item is placed in front of the client on each trial. The amount of time that the client engages (physically interacts) with each stimulus during the trial(s) provides the measure with which to compare the stimuli. DeLeon et al. found that the engagement-based assessment produced somewhat more differentiated results than an MSWO

assessment. Across these three studies, it was found that high-duration stimuli increased response rates when provided as a consequence for a target behavior, and that low-duration stimuli did not increase responding. One limitation of this type of assessment is that it has limited utility for testing food preferences, due to the problem of rapid eating. Hagopian et al. suggested that it would be useful to systematically examine discrepancies in the results between approach and engagement-based preference assessments, a suggestion that has been incorporated into the current study.

In 2003, Spevack et al. conducted a study to determine if Green and Reid's (1996) "Fun Time" procedure could be used as an SS preference assessment to identify HP items and reinforcers for four children with PMD. They presented 12 stimuli noncontingently for 60 s, and watched for the occurrence of approach, avoidance, happiness and unhappiness behaviors. Each stimulus was presented for a total of 10 trials. For two participants, the occurrence of approach behaviors was the most discriminative between the various stimuli, and for two participants it was happiness behaviors. When the two highest and two lowest-ranked stimuli were tested for their reinforcing value, the "Fun Time" assessment successfully predicted the reinforcing value of the stimuli for only one of the three participants who completed the reinforcer assessment.

The last type of preference assessment that has been researched with individuals with MR is a free-operant preference assessment. Roane, Vollmer, Ringdahl, and Marcus (1998) placed 10 or 11 stimuli in a circle on a table, and recorded the number of 10 s intervals that the participants physically manipulated each item, using a partial-interval recording system. They found that this method differentially identified one or more HP stimuli for all 10 participants, and was successful in identifying reinforcers for 8 of the participants. One of the advantages of this style of assessment is that free-operant behavior is not limited by procedural factors such as trial

presentations. Also, the preferred stimuli are never removed, which may lead to fewer aberrant behaviors during the assessment. Two disadvantages of this method are that it does not necessarily produce a discrete ranking of the stimuli according to the client's preferences, and that continuous access to the stimuli may lead to satiation.

No matter which method is used, it is important to periodically re-assess individuals' preferences. It has been shown that clients' preferences change over time (Fisher et al., 1996; Green et al., 1991; Higbee et al., 2000; Kennedy & Haring, 1993; Logan & Gast, 2001; Lohrmann-O'Rourke & Browder 1998; Mason et al., 1989), so occasionally reassessing individuals' preferences will allow caregivers to use the best reinforcer possible.

For individuals with profound MR, the more complex techniques may not be feasible. Many of these individuals do not have the scanning skills to be able to look at a number of items and choose between them. Others may not have the physical skills necessary to grab or point to a preferred item, especially those with very little intentional movement. Those individuals with visual impairments may not be able to see several items in order to choose between them. Because of these difficulties, the SS method of preference assessment is the most commonly used method with persons with profound MR (Logan & Gast, 2001).

Testing for the Reinforcing Value of Stimuli

It is often difficult to identify effective reinforcers for individuals with developmental disabilities, especially for individuals with PMD (Green et al., 1988). Reinforcers are very important tools in helping these individuals acquire new skills, and the use of effective reinforcers is essential for a successful training program. It is a known fact that "reinforcement works," and that carefully selected reinforcement "works best" (Mason et al., 1989). Today's best practice in developing training programs for individuals with MR is to use a systematic

assessment to identify highly preferred stimuli that can be used as reinforcers for these individuals (Green et al.).

Unfortunately, highly preferred stimuli as identified in a preference assessment are not always strong reinforcers. It has been found that no matter which type of preference assessment has been used, the high preference stimuli must be tested to ensure that they will function as reinforcers (DeLeon et al., 1999; Logan & Gast, 2001; Logan et al., 2001; Pace et al., 1985; Roscoe et al., 1999). A possible reason for this finding is that the client may find the high preference stimulus reinforcing enough to choose it in the assessment, and it may even increase a simple response (e.g., switch-pressing), but it may not be a strong enough reinforcer to maintain a more difficult or effortful behavior (Higbee et al., 2000).

Another common finding is that the results of a preference assessment may indicate that the stimuli are all of a fairly similar preference level. However, this may be because the stimuli are all HP or all LP stimuli, and only a reinforcer test would be able to discover which stimuli function as reinforcers for the individual (DeLeon et al., 1999).

The basic strategy to test for the reinforcing value of stimuli is simple. Choose a behavior that occurs occasionally, and follow each instance of the behavior with a presentation of the hypothesized reinforcer. If the behavior increases, then the stimulus is a reinforcer (Martin & Pear, 2003). Beyond this, however, there have been a number of different methods used to test for reinforcers with individuals with MR.

The most common research design used for testing potential reinforcers has been the ABAB design, and variations of this design (ABCB, ABACAD, etc.). When this design is used, a block of sessions is typically conducted under baseline (no consequence) conditions, and during the other blocks of sessions, a stimulus is presented as a consequence for a target

behavior. Often, several stimuli, which have been assessed at different levels of preference (high preference, moderate preference, low preference) are tested in subsequent blocks, to determine if the participant's rate of responding is different in the reinforcement and baseline conditions (Green et al., 1988, 1991; Ivancic & Bailey, 1996; Logan et al., 2001; Pace et al., 1985; Paclawskyj & Vollmer, 1995; Piazza, Fisher, Hanley, et al., 1996).

The second most common design is a concurrent-operants design, where participants can choose to respond in one of two ways to receive either a highly preferred stimulus, a less preferred stimulus, or no consequence. For example, responses on the blue switch on the left will result in access to a highly preferred item, whereas responses on the red switch on the right will have no consequence (Fisher et al., 1992, 1996; Roscoe, et al., 1999; Piazza, Fisher, Hagopian, Bowman, & Toole, 1996). This design measures the relative reinforcing value of the two stimuli presented as consequences, and as such is similar to a paired-stimulus preference assessment containing only two items.

Another design is an alternating treatment design where, in each session, the stimulus that is the consequence for the target behavior is alternated among several that are being tested for their reinforcing value (with or without a baseline phase) (Hagopian et al., 2001; Higbee, et al., 2000). In a fourth design, a progressive ratio schedule, each stimulus is tested using an increasing fixed ratio (FR) schedule, to discover how high an FR schedule can be implemented before responding decreases or ceases (Roane et al., 2001).

There are a number of different target behaviors that have been selected for reinforcer testing with persons with MR, including micro-switch pressing (Higbee et al., 2000; Ivancic & Bailey, 1996; Logan et al., 2001; Roscoe et al., 1999), in-square (standing in one square on the floor or another) or in-seat behavior (Fisher et al., 1992, 1996; Hagopian et al., 2001; Piazza,

Fisher, Hagopian, et al., 1996), and simple motor responses (Green et al., 1988, 1991; Roane et al., 2001; Pace et al., 1985; Paclawskyj & Vollmer, 1995; Piazza, Fisher, Hanley, et al., 1996). All of these have been found to be effective in identifying reinforcer effects for individuals with developmental disabilities. Which method and target behavior to choose must be based on the capabilities of the individual participants.

SS Preference Assessments and Reinforcer Assessments with Persons with Profound MR and PMD

The study that led the way in assessing preferences for persons with profound MR was conducted by Pace et al. (1985). They presented a variety of stimuli that stimulated different senses to children with profound MR. When each stimulus was placed in front of the participant, the experimenter recorded whether the participant made an approach response to the stimulus within 5 s of it being presented. They defined approach as "the child moving toward the object or event with hand or body within 5 s (p. 251)." Once an approach behavior occurred, the participant was given access to the stimulus for a short time (5 s). Each stimulus was presented individually, until each of the 16 stimuli had been presented a total of 10 times each. They found that participants approached different stimuli for different proportions of stimulus presentations. HP and LP stimuli were identified on an individual basis. They defined an HP stimulus as one that a participant approached during 80% or more of the presentations. An LP stimulus was defined as one that a participant approached during less than 50% of presentations. When the HP items were presented as consequences for functional behaviors, the rate of correct responding increased for all 6 participants. The LP stimuli did not increase correct responding, except for one LP stimulus for one participant. The researchers found this procedure to be easy to administer, time efficient, and economical (any staff person could be taught to do this).

Green et al. (1988) used an SS preference assessment to identify preferred stimuli and reinforcers for 7 adults and children with PMD. They presented 12 stimuli 36 times each. Once the stimulus was placed in front of the participant, he or she had 5 s in which to display an approach or happiness behavior, in order to receive the stimulus for a short time. The researchers were able to identify an HP stimulus for 5 of the 7 participants, and for each participant, the HP item was also a reinforcer for a functional skill.

These researchers also had caregivers of the participants rank the stimuli according to their opinion of the participants' preferences. There was no correlation between caregiver opinion and the systematic assessment results. When the stimuli that were ranked as HP and LP by the SS assessment and caregiver opinion were compared, they were not equally effective in identifying reinforcers. A number of stimuli were assessed for each participant. Of those stimuli that were ranked as HP by both the caregiver and the assessment, five out of six were reinforcers when tested. Of those stimuli that both ranked as LP, zero out of two were reinforcers. Of those stimuli that one ranked as HP and the other as LP, one out of five were reinforcers when tested. This study showed that reinforcers can be identified for individuals with PMD with a reasonable degree of reliability, but there is still a need to improve the procedures, and to improve their effectiveness in predicting which stimuli will act as reinforcers (Green et al., 1988).

Green et al. (1991) replicated and extended their 1988 study with adults and children with PMD. They used the same method of conducting an SS preference assessment as in the previous study. They were able to identify an HP stimulus for 5 of the 6 participants, and found that for 4 of those 5 participants, the HP stimulus was an effective reinforcer. They tried a second time with the participant for whom they had not been able to discover an HP stimulus, and included 5 more participants at this point. This time, they asked caregivers to nominate stimuli that might be

reinforcing for these individuals. They were able to identify HP stimuli for 2 of the 6 participants.

The researchers tested the consistency of the results of the preference assessment by testing 12 participants with an SS preference assessment once, and again 28 months later. They found that individual preferences were fairly consistent across time. For one participant, the two assessments were not significantly correlated, for three participants the significance level of the correlation was .10, and for the remaining eight participants, the significance level was .025 or less. This shows that for these individuals their preferences remained relatively consistent, even over a long period of time (Green et al., 1991).

Fisher et al. (1992) compared the SS and PS methods by conducting each of these preference assessments with their participants, then testing for the relative reinforcing value of the HP stimuli identified by each assessment method with a concurrent-operants test. They included one participant with profound MR. The preference response in the SS assessment was defined as a physical approach response, and the participant had 5 s to approach a stimulus in order to gain access to it. For the SS assessment, 16 stimuli were presented individually until each had been presented 10 times. For the PS assessment, the participant had 5 s to approach one of the two stimuli placed in front of him to gain access to it for a short time. The stimuli were paired once with every other stimulus, for a total of 120 presentations.

The researchers found that when the SS method was used, the participant displayed similar rates of approach across many of the stimuli. When the PS method was used, there was more differentiation among the items in the assessment. Those stimuli that were ranked as HP on both assessments maintained more responding in a concurrent-operants reinforcer test in comparison with those ranked as HP by the SS assessment, but as LP by the PS assessment

(Fisher et al., 1992).

Ivancic and Bailey (1996) compared two groups of participants with profound MR. There were 5 individuals in the control group who were diagnosed with profound MR. There were 10 participants with profound MR who had been identified by their caregivers as having chronic training needs, and a long history of training failure. They assessed these 15 individuals with an SS preference assessment, in which the participants had 5 s to make an approach or happiness response to a stimulus in order to gain access to it. During the reinforcer testing, the HP stimulus was presented contingent upon pressing a micro-switch. They were able to discover an HP stimulus for all 5 control participants, and 2 of the chronic training needs participants. The HP stimulus functioned as a reinforcer for 4 participants, all of whom were in the control group. They also learned that the individuals in the control group showed a shorter response latency when presented with HP and LP stimuli, and more intervals containing movement in comparison to the chronic training needs group. Ivancic and Bailey recommended taking into account an individual's response latency when designing a preference assessment for these individuals.

Piazza, Fisher, Hanley, et al. (1996) investigated an SS preference assessment procedure in which the participants were given access to each stimulus individually for 30 s, and the duration that they interacted with the stimulus was the measure of preference. They were able to identify an HP stimulus for both participants with PMD. A reinforcer assessment was conducted in which the participants were presented with an HP or LP stimulus when head turning responses were completed on request. They found that HP stimuli did increase compliance and that LP stimuli did not. However, the presence of HP stimuli did not necessarily eliminate the occurrence of self-injurious behaviors, as was anticipated.

Roscoe et al.'s (1999) study included 4 participants with profound MR, and compared the

PS with an SS preference assessment procedure. All of the stimuli used in this study were edibles. They used a concurrent-operants reinforcer test to assess the relative reinforcing value of the stimuli. They found an HP item for all 4 participants. During the reinforcer test, the participants were required to press one of two switches in order to receive the edible that was associated with each. There was more responding to HP items than LP items. They found that during the SS assessment, there were high rates of approach for all participants and stimuli, leading to a tendency toward false positives when predicting which stimuli would be reinforcers. However, the PS method is insensitive to the absolute reinforcing value of stimuli, and is prone to false negatives. They cautioned researchers that high levels of approach to a stimulus does not guarantee its reinforcing value, and to assess HP stimuli to ensure that they are reinforcers before implementing their use in a training program.

Logan et al., (2001) in Experiment 1, used an SS procedure to identify HP stimuli for 6 individuals with PMD. They spaced their trials out across the participants' days, instead of using a massed-trials approach, and provided 30 s of access to a stimulus if the participant physically approached or smiled within 30 s of the stimulus presentation. With this procedure, they were able to identify an HP stimulus for each participant, but the stimuli were weak, inconsistent, or not reinforcers when tested with an ABAB design for a switch pressing response. However, they only included six stimuli per participant in the SS assessment.

Because of the limitations of Experiment 1, Logan et al. (2001) ran a second experiment in which they sampled 40 stimuli, distributed across auditory, gustatory, olfactory, tactile, thermal, vestibular, visual, and social sensory domains. Each stimulus was presented twice, and the duration of the approach or happiness behavior was recorded. From this information, they identified the top 10 stimuli for approach or happiness duration. These 10 stimuli were presented

for a third and fourth time, and again duration of approach and happiness behaviors were recorded. The three stimuli that had the longest duration of approach responding were tested for their reinforcing value. They discovered that this method identified more HP stimuli than their previous experiment, but they found reinforcers for only 3 of the 5 participants.

In total, eight studies examined the SS preference assessment method involving a total of 55 participants with profound MR, many of whom were also designated as persons with PMD. Researchers were able to discover an HP stimulus for 40 (73%) participants, and of those 40, the preferred stimulus was a reinforcer for 23 individuals (58%) (Fisher et al., 1992; Green et al., 1988, 1991; Ivancic & Bailey, 1996; Logan et al., 2001; Pace et al., 1985; Piazza, Fisher, Hanley et al., 1996; Roscoe et al., 1999; see Table 1).

Those stimuli that a systematic assessment identified as HP functioned more consistently as reinforcers than those stimuli that caregivers reported were preferred stimuli. A consistent finding was that LP stimuli did not function as reinforcers. Some HP stimuli did function as reinforcers, but some did not. As well, the reinforcing effects of the HP stimuli were variable and not always very strong. This shows that preference assessments do not always make good tools for identifying reinforcers (Logan & Gast, 2001).

Discrepancies during Preference Assessments with Persons with Profound MR and PMD

Defining the preference response. There is some disagreement in the preference assessment literature about what response should be measured during SS preference assessments. The original Pace et al. (1985) definition was based on the participant physically moving closer to the offered stimulus. This was labeled approach behavior. A number of studies with individuals with PMD have also used this definition (Roscoe et al., 1999; Fisher et al., 1992; Piazza, Fisher, Hanley, et al., 1996). For the four studies using the approach only definition

Table 1

Summary of the Results of Previous Preference Assessment Research

	n	Diagnosis	Preference Assessment	Response Required	Response Interval	Number of HP Discovered	Number of SR+ Discovered
Pace et al., 1985	6	profound MR	SS	approach	5s	6 out of 6	6 out of 6
Green et al., 1988	7	PMD	SS	approach &/or happiness	5s	5 out of 7	5 out of 5
Green et al., 1991	6	PMD	SS	approach &/or happiness	5s	5 out of 6	4 out of 5
Fisher et al., 1992	1	profound MR	SS & PS	approach	5s	1 out of 1	1 out of 1
Ivancic & Bailey, 1996	10 & 5	PMD & profound MR	SS	approach &/or happiness	5s	2 out of 10, 5 out of 5	0 out of 2, 4 out of 5
Piazza, Fisher, Hanley et al., 1996	2	PMD	SS engagement	approach	30s	2 out of 2	2 out of 2
Roscoe et al., 1999	4	profound MR	SS & PS	approach	5s	4 out of 4	4 out of 4
Logan et al., 2001							
Experiment 1	6	PMD	SS	approach &/or happiness	30s	6 out of 6	0 out of 6
Experiment 2	5	PMD	SS engagement	approach &/or happiness	30s	5 out of 5	3 out of 5

Note. Includes profound MR and PMD participants only.

during SS assessments with individuals diagnosed with profound MR, there were a total of 13 participants. These researchers were able to identify an HP stimulus for all 13 participants, and the HP item was a reinforcer for all 13 (100%).

However, the majority of the recent studies (Green & Reid, 1996; Green et al., 1988, 1991; Ivancic & Bailey 1996; Logan et al., 2001) have accepted either approach behavior or happiness indicators (smiling, laughing, etc.) to indicate a participant's preferences. None of these studies have explained why they included happiness as an alternative to approach. The use of different behaviors to indicate preference may influence the effectiveness of preference assessments for detecting reinforcers for this population.

Among the four studies which defined an approach response as either approach or happiness with participants with profound MR, there were a total of 42 participants (Green et al., 1988, 1991; Ivancic & Bailey, 1996; Logan et al., 2001). They were able to identify HP items for 28 (67%) of the participants, and when a reinforcer assessment was conducted with those 28 participants, the HP items were effective reinforcers for only 16 of those participants (57%).

The results from these two sets of studies indicate that the approach-only definition appears to be the most effective for identifying HP items and reinforcers with this population. One complaint about the SS preference assessment has been that many individuals show high levels of approach behavior to all stimuli, making the assessment poor at discriminating between stimuli. It is possible that the acceptance of happiness or approach responses has made this result more likely, and has led to high levels of false positives in identifying reinforcers.

Choosing the response interval. A second discrepancy in the literature on SS preference assessments is the length of time in which the participant has to make an initial response to each stimulus presentation. The Pace et al. (1985) study had a 5 s time limit for the participant to

approach the stimulus. Most of the studies that used the SS method also used the 5 s response interval. However, for individuals with profound MR, especially those who have low levels of movement, this may not be enough time for the individual to respond to the stimulus, whether preferred or not (Logan & Gast 2001). A longer response interval was also recommended by Ivancic and Bailey (1996), who, after their preference assessment, compared the response latency of a profound MR (control) group with a profound MR plus chronic training needs (minimal movement) group in their reinforcer evaluations. When the control group was presented with HP and LP stimuli, the average response latency was 0.33 and 1.40 min, respectively. When HP and LP stimuli were presented to the minimal movement group, their average response latencies were 4.6 and 5.3 min, respectively. These researchers recommended that an individual's average time to respond should be taken into account when designing a preference assessment, so that it can measure their responses more accurately.

Among the six studies using the 5 s time limit with participants with profound MR or PMD, there were 42 participants (Pace et al., 1985; Ivancic & Bailey 1996; Green et al., 1988; 1991; Roscoe et al., 1999; Fisher et al., 1992). The researchers were able to identify HP items for 28 (67%) of the participants, and reinforcers for 24 (86%).

For the two studies using a response interval of more than 5 s for the participants to respond (30 s), there were a total of 13 participants with profound MR or PMD (Logan et al., 2001; Piazza, Fisher, Hanley, et al., 1996). They were able to identify an HP item for all 13 (100%) of the participants, but of those, only 5 (38%) were reinforcers.

While there are only two studies that have used a response interval of more than the standard 5 s for the SS preference assessment, the research thus far indicates that the longer response interval is not as effective as the 5 s interval. The little data available suggests that the

longer response interval may allow researchers to identify highly preferred stimuli for a larger proportion of individuals with profound MR, but that it is less able to demonstrate that the HP stimuli are reinforcers.

Including edibles and non-edibles in the same preference assessment. A third discrepancy in the literature is the inclusion of edibles and non-edible stimuli (olfactory, visual, auditory, social, etc.) in the same preference assessment. Bojak and Carr (1999) conducted an MSWO preference assessment with individuals with severe MR who had no physical or sensory impairments. When both edible and non-edible stimuli were included in the assessment, all of the participants selected all of the edible items before selecting any other stimuli. It is known that leisure items do have reinforcing properties for these individuals, and yet the preference assessment results would suggest otherwise. The participants even selected the edible items first when the assessments were conducted right after meal times. The authors suggested that there may be less response effort required to consume food compared with interacting with leisure items. They recommended that separate assessments be conducted with edible and non-edible stimuli, so that the assessments do not underestimate the reinforcing value of non-edible reinforcers (Bojak & Carr, 1999; Higbee et al., 2000).

In studies of persons with profound MR, all of the SS assessments have included edibles and non-edibles, except for one (Roscoe et al., 1999), which included only edibles. Of the studies that conducted an SS preference assessment with individuals with profound MR or PMD, there were a total of 55 participants. The researchers found an HP stimulus for 40 individuals, and of those, 21 of the HP items were edibles. When the reinforcing value of the edible and non-edible HP stimuli are compared, 19 of the 21 edible HP items were reinforcers when tested (90%), while 10 of the 19 non-edible HP items were reinforcers (53%) (Fisher et al., 1992; Green et al.,

1988; 1991; Ivancic & Bailey, 1996; Logan et al., 2001; Pace et al., 1985; Piazza, Fisher, Hanley et al., 1996; Roscoe et al., 1999). This indicates that when edible stimuli are the most highly preferred, they function as reinforcers more often than highly preferred, non-edible stimuli for this population. However, from this evidence, it cannot be determined whether the presence of edible stimuli in the SS assessment influenced the way in which the participants responded to the non-edible stimuli.

Statement of the Problem

What is the best preference response and the best response interval to use when conducting an SS preference assessment with nonedibles for individuals with PMD? Will stimuli that are identified as highly preferred also function as reinforcers? These questions were explored through two experiments. The first experiment investigated which of two preference responses was more sensitive in identifying preferred stimuli and reinforcers for individuals with PMD. The most highly preferred stimuli determined by preference assessment were compared to the participants' teachers' ratings regarding the most highly preferred stimuli. The second experiment investigated which of two response intervals was more effective at identifying preferred stimuli and reinforcers for individuals with PMD.

Experiment 1

A Comparison of Two Client Responses versus Staff Opinion to Assess Preferences and Reinforcers with Persons with PMD

Method

Setting and Participants

The participants were 8 children and adults with PMD. They were all diagnosed with MR or developmental delays, were nonambulatory, nonspeaking, and had at least one other disabling

condition (e.g., seizure disorder, sensory impairments), while being capable of at least one voluntary approach response, and were able to press a micro-switch. Because most of them were not diagnosed with a specific level of MR in their chart records, the Vineland Adaptive Behavior Scales (VABS; Sparrow, Balla, & Cicchetti, 1984), and the Bayley's Scales of Infant Development - II (Bayley, 1993; see Appendix B) were conducted as an interview with staff members familiar with each of the participants to determine an estimate of their functioning levels. The staff members or teachers had known the participants for an average of 14 months (range 5-24 months). To protect their confidentiality, their names have been changed.

Additionally, an assessment of each participant's movement abilities was conducted, according to the procedure used by Ivancic and Bailey (1996). The participants were each observed individually for 7 min across two separate days, using a 5 s partial-interval recording system (see Appendix C). Intentional movements of 2 cm or greater in the 5 s intervals were recorded, and the percentage of intervals with movement occurring was calculated. All eight participants met the criteria for PMD, having profound MR, profound physical disabilities, and at least one additional disabling condition. Fran was classified as having minimal movements as well as PMD (Ivancic & Bailey, 1996). For the participants' characteristics and assessment results, see Table 2.

The participants were all residents of St. Amant, a residential and community resource center for individuals with developmental disabilities located in Winnipeg, Manitoba, Canada. The sessions were conducted in a quiet session room, with only the experimenter, the participant, and occasionally an observer present.

Materials

A list of potential stimuli was generated from reviewing the research literature, as well as

Table 2

Participant Information for Experiment 1

			BSID-II				VABS				
Name	Age	Diagnoses	Mental Scale*	Motor Scale*	Total	% Movement	Comm-unication*	Daily Living*	Soc-ialization*	Motor Skills*	Adaptive Behavior Composite
Adam	6	severe developmental disabilities with severe birth asphyxia spasticity & feeding problems seizure disorder feeding gastronomy	1 mo	<1 mo	Non-Optimal	90%	9 mo	4 mo	13 mo	<1 mo	Profound Deficits
Burt	13	prematurity (34 weeks) developmental delay severe neurodevelopmental dysfunction cortical blindness feeding gastronomy	<1 mo	<1 mo	Non-Optimal	90%	10 mo	4 mo	6 mo	1 mo	Profound Deficits
Chris	5	schizencephaly septo-optic dysplasia hypoplasia of corpus callosum leading to cerebral palsy severe developmental disabilities seizures asthma corrective glasses feeding gastronomy	2 mo	<1 mo	Non-Optimal	83%	11 mo	4 mo	13 mo	<1 mo	Profound Deficits
Edie	31	severe seizure disorder herpes encephalitis partially blind & deaf hemipleagia	5 mo	6 mo	Non-Optimal	93%	9 mo	16 mo	11 mo	16 mo	Profound Deficits

			BSID-II				VABS				
Name	Age	Diagnoses	Mental Scale*	Motor Scale*	Total	% Movement	Comm-unication*	Daily Living*	Soc-ialization*	Motor Skills*	Adaptive Behavior Composite
Fran	44	spastic quadriplegia microcephaly profound mental retardation seizure disorder visual impairment feeding gastronomy	<1 mo	<1 mo	Non-Optimal	25%	5 mo	2 mo	<1 mo	<1 mo	Profound Deficits
Gina	19	cerebral palsy seizure disorder spastic quadriparesis severe developmental delay aggressive behaviors self-injurious behaviors	2 mo	4 mo	Non-Optimal	78%	9 mo	14 mo	5 mo	7 mo	Profound Deficits
Heather	19	cerebral palsy spastic quadriplegic subarachnoid hemorrhage 2nd degree non accidental trauma seizure disorder visual impairment	<1 mo	<1 mo	Non-Optimal	90%	<1 mo	9 mo	<1 mo	<1 mo	Profound Deficits
Ian	20	spastic quadriparesis seizure disorder severe mental retardation	2 mo	<1 mo	Non-Optimal	80%	11 mo	12 mo	7 mo	<1 mo	Profound Deficits

Note. BSID-II : Bayley's Scale of Infant Development - II (Bayley, 1993); VABS: Vineland Adaptive Behavior Scales (Sparrow et al, 1984). The BSID-II was administered as a teacher questionnaire, not as an actual test of the students' abilities. * Age-equivalent scores

speaking with the participants' caregivers and teachers about their preferences and health concerns. Each participant was then presented with 15-20 stimuli, one at a time, and their responses were observed and recorded. Each stimulus was presented for 60 s, and the occurrence of happiness, unhappiness, approach or avoidance behaviors during that time were recorded (see definitions below). From this, the six stimuli that generated the most active or positive responses were selected individually for each participant, ensuring that there were no more than two stimuli from any one sensory area (e.g., auditory, visual, tactile, olfactory, temperature). These stimuli were then used in the preference assessments. The stimuli used in this experiment were: a rotating multi-coloured disco ball, a plastic toy with flashing lights (light toy), coffee grounds (coffee scent), a plastic bin with warm water and floating plastic toys (water toy), music from the Lion King movie soundtrack, a vibrating back massager, a teddy bear, a hand-held fan, a recording of a drum solo, a warm gel pack, an unlit cherry-scented candle, a plastic hand clapper, a fluorescent pink feather boa, a warm damp facecloth, a plastic slinky, Elvis music, an unlit hazelnut-scented candle, and the experimenter reading a story aloud. Gustatory stimuli were not included because most of the participants were on gavage feed and had restricted diets. The stimuli were chosen in order to provide an opportunity to investigate an SS preference assessment that included only non-edible stimuli, which has not yet been reported in the literature.

Design and Procedure

Overall design. Experiment 1 was designed to answer the question of which of two preference responses was the most sensitive in identifying HP stimuli and reinforcers for individuals with PMD. The design was an ABAB design, and half of the participants were randomly selected to receive the conditions in the reverse order, BABA.

The A phases were an SS preference assessment procedure in which the preference response was defined as including only physical approach behaviors. Once each preference assessment was completed, the stimulus that was identified as the HP stimulus (as described below) for each individual was tested for its reinforcing value. The B phases used the same SS preference assessment procedure, except that the preference response was defined as an approach and/or a happiness behavior. The stimulus that was identified as the HP stimulus for each individual was then tested for its reinforcing value. Each participant experienced both preference assessment procedures twice, followed by reinforcer testing, except for Chris, who passed away after completing each procedure once.

SS preference assessment procedure. The preference assessment procedures used during the A and B phases were identical, except that the preference response was approach behaviors in the A phases, and approach and/or happiness behaviors in the B phases. An approach response was defined as any physical response that increased the participant's coming into contact with the stimulus. This included behaviors such as turning one's head or body toward the stimulus, reaching for the stimulus, or using one's hands to manipulate the stimulus. The definition of a happiness behavior was the same as described in Green and Reid (1996): "any facial expression or vocalization typically considered to be an indicator of happiness among people without disabilities, including smiling, laughing, and yelling while smiling (p. 69)." Additionally, instances of avoidance or unhappiness behaviors were recorded. Avoidance responses were defined as any physical response that decreased the participant's contact with the stimulus. This included behaviors such as turning one's head or body away from the stimulus or pushing the item away. An unhappiness behavior was defined according to Green and Reid's definition: "any facial expression or vocalization typically considered to be an indicator of unhappiness among

people without disabilities, such as frowning, grimacing, crying, and yelling without smiling (p. 69)."

During a preference assessment, a stimulus was placed in front of the participant. He or she was given 5 s to engage in a preference response, according to the definition in place for each phase. If the preference response occurred, the participant gained access to that stimulus for 15 s. Once the participant was given access to the stimulus, the length of time that the participant engaged with the stimulus was also recorded, up to the 15 s maximum. If no response occurred, the trial was scored as "no response," and after the inter-trial interval, the next trial was presented. If at any time, avoidance or unhappiness behaviors occurred, the stimulus that was being presented was removed, and after the inter-trial interval, the next trial was presented. There was an inter-trial interval of approximately 30 s, and 10-20 trials were conducted per session. The six stimuli were randomly alternated within each session, according to a predetermined random order of presentation (see Appendix D & E for data sheets), and sessions continued until each stimulus had been presented 10 times.

Both Burt and Heather were diagnosed with visual impairments. Because of this, the method of presentation for them was slightly altered. Following the procedure described by Paclawskyj and Vollmer (1995), these participants were allowed to interact with each stimulus (hear, smell, touch it, etc.) for 3 s. After this, the stimulus was removed, and the participants were then given 5 s in which to engage in a preference response, in order to receive the stimulus for the full 15 s.

The experimenter (and occasionally an independent observer) recorded the participant's responses during the 5 s stimulus presentations. Observations were made of approach behaviors, avoidance behaviors, happiness behaviors, unhappiness behaviors and response latency that

occurred within the duration of the presentation, as well as the length of time (up to 15 s) that the participant engaged with the stimulus after making a preference response.

Reinforcer test. After each preference assessment was completed, a reinforcer test was conducted to determine if the stimulus that was identified as the HP stimulus in the preference assessment was indeed a reinforcer for that individual. Pace et al. (1985) defined an HP stimulus as one that the participant approached during 80% or more of the preference assessment trials. If there was more than one stimulus that met this criterion, then the stimulus which had the highest proportion of trials with approach responses was selected for the reinforcer test. If no stimulus was identified as an HP stimulus, then the most highly preferred stimulus was tested. In the case of a tie for the most highly preferred stimulus, one was selected randomly, or if one of the stimuli had been tested as an HP stimulus in a previous test, then one was randomly selected from the remaining highly preferred items.

For Gina, the same stimulus (the slinky) was her most preferred stimulus in all four preference assessments. Because of this, it was used in the first two reinforcer tests (one B and one A phase), and the second most preferred stimulus was selected for the second two reinforcer tests, in order to maximize the likelihood that we would identify a reinforcer for her.

Within each A or B phase, the reinforcer tests (conducted to determine if an HP stimulus functioned as a reinforcer) also used an ABAB design, which alternated between baseline (no consequence following target behavior) and reinforcement (HP stimulus as a consequence for target behavior) conditions. In a couple of instances, the results were unclear, and so a third AB replication was conducted. Participants were reinforced for switch pressing on an FR 1 schedule, to maximize the likelihood that the participants' responding would come under the control of the contingency in place.

The target behavior that was consequated with the HP stimulus was pressing a micro-switch. Switch pressing is a functional behavior that many of these participants were using in their classrooms to activate leisure items and communication devices, and is often used for this population for recreation, choice-making and communication (Logan et al., 2001). Adam, Burt, Chris, Edie, Gina, and Ian used a "One-Step" switch which was placed on the tray of their wheelchair in a spot that was easily accessible for each individual to reach with their hands. Fran and Heather used a "Jellybean" switch which was attached to an apparatus on their wheelchairs, and they pressed it using their heads. The switches and placement of the switches used were consistent with how the participants used switches in their daily programs. Both types of switches required 2-3 g of force to activate, according to the manufacturer.

Before each session began, three pre-session primer trials were conducted to familiarize the participant with the contingency in place (as in Ivancic & Bailey, 1996). When necessary, the experimenter prompted or physically guided the participant to press the micro-switch for these trials, then presented the stimulus that was the consequence during the session. The dependent measure was the number of times that the participant pressed the switch during the 15-min session. The timer was stopped during presentation of the reinforcer, to ensure that all participants were given the same amount of time in which to engage in the target response.

Most of the participants received reinforcer test sessions of 15 minutes in duration. Due to high rates of switch pressing, Heather had 15 min sessions for the first reinforcer test, and 5 min sessions for the last three tests. For the same reason, Ian had 5 min sessions for all four reinforcer tests. This was done in order to avoid satiation of the HP stimulus, and to reduce the sessions to a manageable length (approximately 30 min).

Teacher's Rankings of the Stimuli

Before the first preference assessment was completed, the experimenter consulted with an experienced teacher or caregiver who was familiar with each of the participants. The teacher was asked to rank the stimuli that were being presented in the preference assessment according to which he or she felt would be more and less preferred for each participant. These rankings were compared to the results from the preference assessments.

Reliability

Interobserver reliability. Before data collection began, the experimenter and observer(s) familiarized themselves with the response definitions and practiced recording until interobserver agreements exceeded 80% for several practice sessions. During reliability checks, the experimenter and an observer independently recorded the dependent measures on each trial. To control for any possible experimenter bias, the observers were not informed of the hypotheses of the study. For the discrete behaviors, a trial was considered an agreement if the observer and the experimenter recorded the occurrence of the same dependent measure, and a disagreement if the recordings differed. Interobserver agreement was calculated for each behavioral measure by dividing the number of agreements by the number of agreements plus disagreements, and then multiplying by 100%. For response latency and engagement time, reliability was calculated by dividing the smaller time by the larger time, and then multiplying by 100%.

Reliability checks were conducted for 67% of movement observation sessions, across all participants. Interobserver agreement averaged 93% (range 70-100%) (see data sheet, Appendix C).

Reliability checks were conducted for 55% of all preference assessment sessions, across all phases and participants. Interobserver agreement averaged 99% (range 77-100%; 1 session below 80%) for approach responses, 100% (range 87-100%) for avoidance responses, 96%

(range 50-100%; 2 sessions below 80%) for happiness responses, 100% (range 93-100%) for unhappiness responses, 99% (range 87-100%) for no response, 88% (range 59-100%; 8 sessions below 80%) for response latency, and 96% (range 66-100%; 1 session below 80%) for engagement time (see data sheet, Appendix E).

Reliability checks were conducted for 43% of reinforcer test sessions, across all participants and conditions. Interobserver agreement on number of switch presses per session averaged 100% (see data sheet, Appendix F).

Procedural integrity. Procedural integrity was also assessed by the observer, using a procedural checklist. On each trial, the observer recorded whether the experimenter was following the procedures correctly. For example, the observer recorded whether the experimenter presented the correct stimulus, if the correct verbal cue was used, whether the experimenter used the correct definition of the preference response for the phase in progress (approach only versus approach and/or happiness), and if the stimulus was removed promptly when an avoidance or unhappiness behavior occurred. A trial was considered correct if all the steps were carried out appropriately by the experimenter; otherwise, it was considered an error.

Procedural integrity checks were done for 55% of all preference assessment trials, across all participants and phases. Procedural integrity for sessions averaged 100% (range 93-100%; see data sheet, Appendix E).

Procedural integrity checks were done for 43% of reinforcer test sessions, across all conditions and participants. Procedural integrity for the reinforcer test sessions averaged 100% (see data sheet, Appendix F).

Results

Determination of a Differential Stimulus Hierarchy

There was not a large difference in the stimulus hierarchies between the two types of preference assessments when the preference response was approach behavior versus approach and/or happiness behaviors. For the approach only definition, there was an average of 16 responses per assessment (out of a maximum of 60) across all participants. The amount of responding ranged from 0-8 responses per stimulus, with an average of 3 (out of a maximum of 10). For the approach and/or happiness definition, there was an average of 18 responses per assessment. The amount of responding per stimulus ranged from 0-9, with an average of 4. Approach and happiness responses often occurred together during the same trial, thus adding happiness to the response definition did not often increase the number of trials that were responded to. For an example of preference assessment data for a participant, see Figure 1. The data for all the participants is shown in Appendix G.

Unhappiness and avoidance responses happened very infrequently for most participants. Across all four preference assessments, with a possible 240 opportunities to respond, no unhappiness or avoidance behaviors occurred for Adam and Heather, one avoidance behavior occurred for Burt, 3 avoidance behaviors occurred each for Chris and Edie, 1 unhappiness and 1 avoidance behavior occurred for Ian, 1 unhappiness behavior occurred for Fran, and 22 unhappiness behaviors occurred for Gina. Because of the infrequency of these responses, they were not useful in adding to the measuring of preferences.

Engagement time was also not a useful measure of preference. Engagement with each stimulus involved different behaviors (looking, smelling, touching, listening) for each stimulus. The response effort for each of these behaviors is different, and for some stimuli (e.g., auditory and olfactory) the engagement time was 100%.

Neither type of preference assessment response was very effective in identifying HP

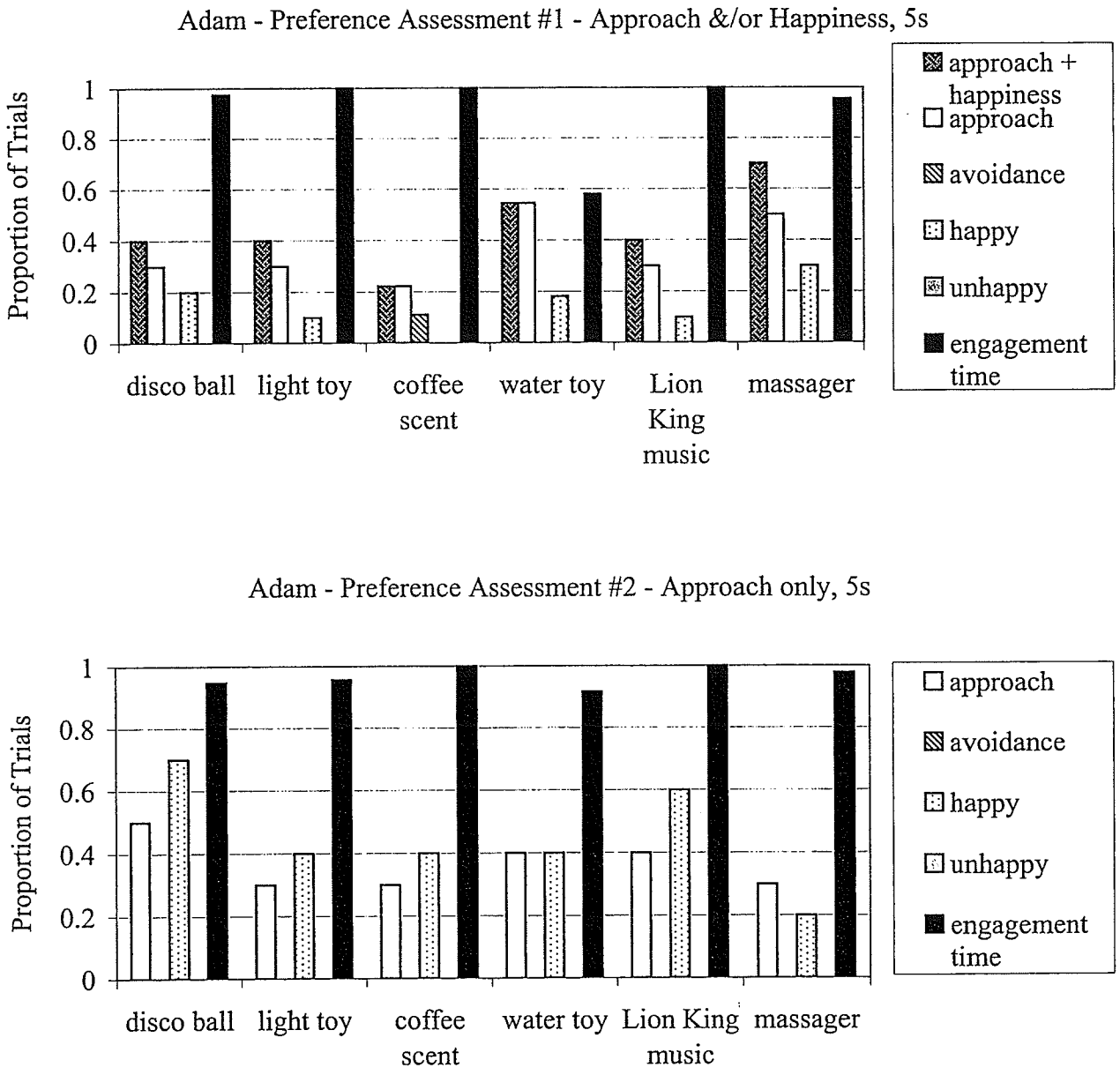


Figure 1. Sample preference assessment results.

items according to Pace et al.'s (1985) 80% criterion (see Table 3). The preference assessments using the approach definition identified an HP stimulus for one participant (Gina), whereas the approach and/or happiness definition identified an HP stimulus for two participants (Gina and Edie). In cases where no HP stimulus was identified according to the Pace et al. definition, the stimulus with the highest percentage of responses was selected for the reinforcer test.

Reinforcer Test Results

The reinforcer test data was analyzed using the guidelines for the visual inspection of data outlined by Martin and Pear (2003). They stated that there is greater confidence that a treatment effect has been observed "the greater the number of times that it is replicated, the fewer the overlapping points between baseline and treatment phases, the sooner the effect is observed following the introduction of the treatment, and the larger the effect is in comparison to baseline" (p. 291). To determine if a stimulus functioned as a reinforcer, the reinforcer test data for a participant was analyzed by using these rules to examine each set of 3 adjacent phases in the ABAB design, the ABA phase and then the BAB phase. Therefore each reinforcer test required two decisions to be made about whether there was an effect or not (or four decisions for those tests that had a third AB replication). Sample data for two participants is shown in Figure 2. From that data, it was concluded that the most highly preferred stimulus functioned as a reinforcer for Chris in the ABA comparison, and not in the BAB comparison, but the preferred stimulus was not a reinforcer for Adam in either comparison. Individual data for all participants is shown in Appendix H.

The experimenter as well as two senior graduate students with experience in single-subject research designs examined the reinforcer test data using the above rules, and independently made decisions about whether there was a reinforcer effect in each ABA or BAB

Table 3

Number of High Preference Stimuli Identified by each type of Preference Assessment

	Approach Only		Approach &/or Happiness	
Participant	Number of HP Stimuli Found*	Highest Approached Stimulus**	Number of HP Stimuli Found***	Highest Approached Stimulus***
Adam	0	50%	0	70%
Burt	0	30%	0	20%
Chris	0	50%	0	30%
Edie	0	60%	3	90%
Fran	0	30%	0	50%
Gina	1	80%	1	90%
Heather	0	70%	0	50%
Ian	0	40%	0	60%

Note. * An HP stimulus is one that was approached on 80% or more trials. ** The highest percentage of trials that a stimulus was approached. *** An HP stimulus is one that was approached and/or evoked happiness on 80% or more trials. **** The highest percentage of trials that a stimulus was approached and/or evoked happiness.

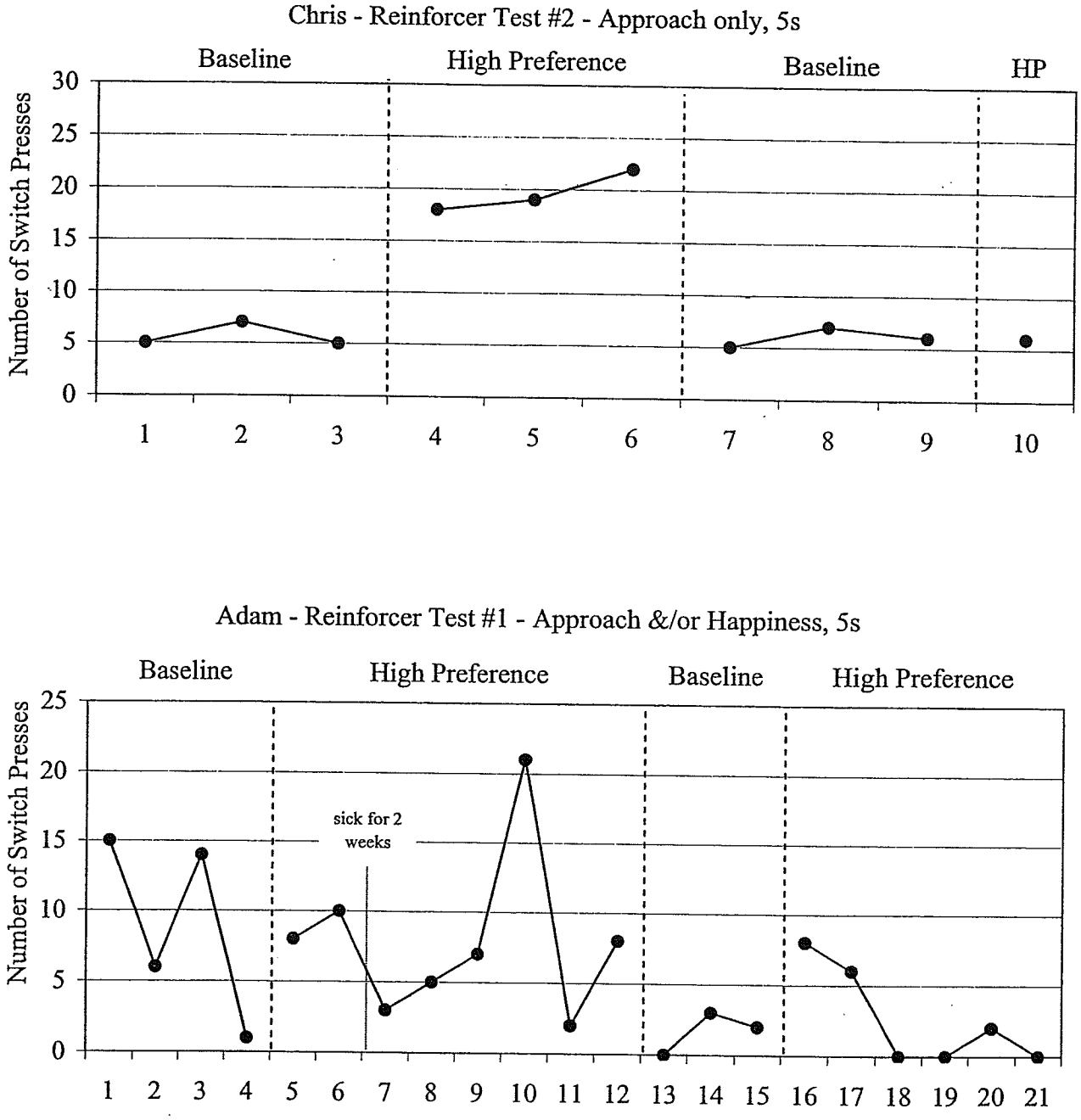


Figure 2. Sample reinforcer test results.

phase. This was done in order to calculate a reliability measure for these decisions. The percent agreement between the experimenter's and students' decisions, calculated as indicated on p. 33, were 90% and 92%, respectively.

Overall the most preferred items (HP or otherwise) for each participant and in each assessment were tested for their reinforcing value. Across all of the reinforcer tests, the approach and/or happiness definition was slightly better in identifying reinforcers, compared with the approach only definition. Out of 34 ABA/BAB tests for each response definition, the approach and/or happiness definition discovered 20 reinforcers, while the approach only definition discovered 17 reinforcers (see Table 4). Across all participants, each response definition identified a reinforcer in at least one reinforcer test for 7 of the 8 participants (see Table 5). Neither definition was clearly superior in identifying reinforcers, whether in total, or on a per participant basis.

There were two participants (Gina and Edie) for whom an HP stimulus (responding >80%) was identified through using the approach and/or happiness response definition, and the HP stimuli were both reinforcers for the switch-pressing response (see Appendix H for all reinforcer test data). There was one participant (Gina) for whom an HP stimulus was identified using the approach only definition, and that stimulus was not a reinforcer for switch pressing. Of the most highly preferred stimuli identified with the approach response (responding <80%), 17 out of the 34 tests discovered reinforcers. For the most preferred stimuli identified by the approach and/or happiness definition, 17 out of 30 were reinforcers.

Comparing the Teachers' Rankings with Preference Assessment Results

Before the first preference assessment was completed, the teacher or staff member most familiar with a participant was asked to rank the stimuli according to what he/she felt that the

Table 4
Summary of Results of Reinforcer Tests for Experiment 1

	Response Definition	
	Approach	Approach &/or Happiness
Reinforcer found	17 (50%)	20 (59%)
No reinforcer found	17 (50%)	14 (41%)

Table 5

Summary of Results of Reinforcer Tests for Experiment 1 by Participant

	Were the Most Preferred Stimuli Reinforcers?			
	Approach #1	Approach #2	Approach &/or Happiness #1	Approach &/or Happiness #2
Adam	no, no	no, no, yes, no	no, no	no, no, yes, no
Burt	no, no	yes, no	no, no	no, no
Chris	yes, no	--	yes, yes	--
Edie	yes, yes	yes, yes	yes, yes	yes, yes
Fran	yes, yes, yes, yes	yes, yes	yes, yes	yes, yes
Gina	no, no	no, no	no, yes	no, no
Heather	yes, yes	no, no	yes, no	yes, yes, yes, yes
Ian	yes, yes	no, no	yes, no	yes, yes

participant's preferences were. For each participant this was compared with the hierarchy produced by the first preference assessment completed by that participant. Overall, the teachers' rankings and the preference assessment results were very poorly correlated (i.e. Table 6). When looking at the most preferred item identified in the first preference assessment for each of the 8 participants, the teachers rankings agreed for only 3 participants. Of the total of 20 reinforcers found in Experiment 1, the teachers ranked only 5 as the most preferred stimuli for the participants.

Discussion

It was expected that there would be higher rates of responding during preference assessments when the more inclusive response definition was used. This did not occur because happiness and approach responses often happened together during a trial, so that the more inclusive definition did not increase the overall number of trials with preference responses.

Neither preference response definition was superior in identifying highly preferred stimuli and reinforcers. The approach definition identified 17 reinforcers while the approach and/or happiness response definition identified 20 reinforcers. Despite the fact that neither response definition was clearly superior to the other, we recommend that future studies use the approach and/or happiness definition because it is the most inclusive definition, and there may be some participants that can express their preferences more accurately using happiness behaviors.

It appears that Pace et al.'s (1985) 80% guideline for selecting HP stimuli may be too strict for the PMD population. Overall, combining the two response definitions, there were 3 true positives (HP correctly identified as a potential reinforcer), 30 stimuli that were true negatives (correctly identified as not being reinforcers), 1 false positive (HP incorrectly identified as a potential reinforcer), and *34 false negatives* (incorrectly identified as not being reinforcers). The

Table 6

Correlations between the Teacher's Ranking of each Activity and the first Preference Assessment Conducted with each Participant in Experiment 1.

Participant	Activity	Teacher's Ranking	Assessment Ranking	Rank Correlation
Adam	water toy	1	2	0.759
	massager	2	1	$p = 0.080$
	disco ball	3	4	
	Lion King music	4	4	
	coffee scent	5	6	
	light toy	6	4	
Burt	drum music	1	6	0.088
	Lion King music	2	1.5	$p = 0.868$
	gel pack	3	1.5	
	massager	4	3	
	teddy bear	5	4.5	
	fan	6	4.5	
Chris	clapper	1	2	0.765
	fan	2	3.5	$p = 0.076$
	feather boa	3	1	
	disco ball	4	3.5	
	teddy bear	5	5.5	
	cherry scent	6	5.5	
Edie	slinky	1	3	-0.355
	clapper	2	3	$p = 0.490$
	light toy	3	5	
	coffee scent	4	5	
	massager	5	3	
	Lion King music	6	1	
Fran	Elvis music	1	2	0.759
	feather boa	2	2	$p = 0.080$
	fan	3	2	
	hazelnut scent	4	6	
	massager	5	4	
	slinky	6	5	
Gina	light toy	1	5	-0.290
	slinky	2	1	$p = 0.577$
	Lion King music	3	6	
	disco ball	4	4	
	cherry scent	5	2.5	
	teddy bear	6	2.5	
Heather	massager	1	1	0.324
	warm facecloth	2	4.5	$p = 0.531$
	Lion King music	3	2.5	
	read story	4	6	
	cherry scent	5	4.5	
	disco ball	6	2.5	
Ian	Elvis music	1.5	1.5	0.105
	disco ball	1.5	5	$p = 0.843$
	fan	4.5	1.5	
	teddy bear	4.5	3	
	cherry scent	4.5	4	
	warm facecloth	4.5	6	

range of responding to stimuli that turned out to be reinforcers was 1-9 responses (out of 10). The range of responding to stimuli that turned out to not be reinforcers was 0-9.

Consistent with the results in the literature (Hughes et al., 1998; Logan & Gast, 2001; Lohrmann-O'Rourke & Browder, 1998), staff opinion and systematic preference assessment results were poorly related. However, a stronger test would be to conduct a reinforcer assessment with the stimuli that the teachers identified as the most preferred, to determine whether those stimuli were reinforcers in addition to the ones identified by the preference assessments.

It was expected that it would be more difficult to identify reinforcers for the one participant with minimal movement (Fran), as compared to the seven participants with higher levels of movement. However, in Experiment 1, we were more successful in finding reinforcers for Fran than for the other participants. Fran completed four preference assessments, and while none of them identified HP stimuli, all four of her most preferred stimuli were reinforcers (100%). The other participants completed 26 preference assessments in total, and 16 reinforcers were found (62%). Future research should assess whether this finding has generality.

Experiment 2

A Comparison of Two Response Intervals to Assess Preferences and Reinforcers with Persons with PMD

Method

Setting and Participants

Adam, Burt, Edie, Fran and Gina from Experiment 1 participated in Experiment 2. As well, three new participants were included: James, Kelly and Lester. The VABS, BSID-II and movement assessment were conducted for the new participants as well. All three of the new participants were diagnosed with Profound MR, physical disabilities, and at least one additional

disabling condition, and met the criteria for PMD (see Table 7). Fran and Lester were classified as having minimal movements as well as PMD (Ivancic & Bailey, 1996). The sessions occurred in the same session rooms as in Experiment 1. The teachers had known the participants for an average of 44 months (range 12-72 months). To protect their confidentiality, their names have been changed.

Materials

The procedure that was used in Experiment 1 to select the six stimuli for the preference assessments for each participant was also used in Experiment 2. For those participants who were in Experiment 1, the procedure was repeated. The stimuli that were used in this experiment were: a rotating multi-coloured disco ball, a plastic toy with flashing lights (light toy), coffee grounds, a warm damp facecloth, music from the Lion King movie, a vibrating back massager, a fluorescent pink feather boa, a teddy bear, a lightning ball, a warm gel pack, a hand-held fan, a mirror, a recording of a drum solo, a plastic hand clapper, a gentle hand massage, an unlit hazelnut-scented candle, a small fluid-filled rubber ball that looked like an eyeball (squishy eye), Elvis music, Beatles music, bells, a plastic slinky, a wooden frame with multi-coloured bracelets dangling from it (chain toy), and an unlit soap-scented candle.

Lester had one set of stimuli for the first two preference assessments, and a second set for the last two. This was because, during the third preference assessment, he did not respond to any of the stimuli on any trial. Therefore, the selection procedure was repeated, and the six new stimuli were used for his third and fourth preference assessments.

Design and Procedure

The most common standard in the research literature is to allow 5 s for participants to make the initial response in a preference assessment (Fisher et al., 1992; Green et al., 1988;

Table 7

Participant Information for Experiment 2

			BSID-II				VABS				
Name	Age	Diagnoses	Mental Scale*	Motor Scale*	Total	% Movement	Comm - unication*	Daily Living*	Soc- ialization*	Motor Skills*	Adaptive Behavior Composite
James	16	profound mental retardation severe developmental delays feeding gastronomy	<1 mo	<1 mo	Non-Optimal	100%	6 mo	2 mo	4 mo	2 mo	Profound Deficits
Kelly	13	developmental delay, unknown etiology seizure disorder dysphasial reflux cortical blindness feeding gastronomy	<1 mo	<1 mo	Non-Optimal	95%	1 mo	3 mo	<1 mo	<1 mo	Profound Deficits
Lester	12	herpes meningoencephalitis cerebral hypotonia neurodevelopmental delay feeding gastronomy inserted part way through study	<1 mo	1 mo	Non-Optimal	33%	2 mo	7 mo	<1 mo	<1 mo	Profound Deficits

Note. BSID-II : Bayley's Scale of Infant Development - II (Bayley, 1993); VABS: Vineland Adaptive Behavior Scales (Sparrow et al, 1984). The BSID-II was administered as a teacher questionnaire, not as an actual test of the students' abilities. * Age-equivalent scores

1991; Ivancic & Bailey, 1996; Pace et al., 1985; Roscoe et al., 1999). There have been concerns raised (Ivancic & Bailey; Logan & Gast, 2001) that for individuals with PMD, a 5 s window of opportunity to respond may be too brief. A longer response interval might allow more accurate identification of preferred stimuli and reinforcers.

Overall design. Experiment 2 was designed to assess which of two response intervals (5s or 30s) during the preference assessment would be the most effective in identifying preferred stimuli and reinforcers for individuals with PMD. Like Experiment 1, the design was an ABAB design, and half of the participants were randomly selected to experience the conditions in the reverse order, BABA.

The A phases were the SS preference assessment procedure in which the participant was given 5 s to engage in the preference response. The preference response was defined as a physical approach response, using the same definition as in Experiment 1, and was used for both the A and B phases. This definition was used because Experiments 1 and 2 started concurrently, so the definition that was initially hypothesized to be the most effective was selected. Just as in Experiment 1, when each preference assessment phase was completed, the stimulus that was identified as the HP stimulus for each individual was tested for its reinforcing value. If no stimulus was identified as an HP stimulus, then the most preferred stimulus was tested. Ties were resolved as discussed in Experiment 1.

The B phases used the same SS preference assessment procedure, except that the participant was given 30 s to engage in the preference response. The stimulus that was identified as the HP item for each individual was tested for its reinforcing value. If no stimulus was identified as an HP stimulus, then the most highly preferred stimulus was tested. Ties were resolved as described in Experiment 1.

SS preference assessment procedure. The two preference assessment procedures were identical, and the same as in Experiment 1, except for the length of time that the participant was given to engage in a preference response once each stimulus was presented. The trial times and response definitions used were as described above. The experimenter and observer recorded instances of approach, avoidance, happiness, and unhappiness behaviors, as well as response latency, and engagement with the stimulus once it was approached (up to 15 s). Just as in the previous experiment, the six stimuli were randomly alternated within each session (see Appendix D), 10-20 trials were conducted per session, and sessions continued until each stimulus had been presented 10 times.

Burt was diagnosed with visual impairments. Because of this, the method of presentation was altered for him as in Experiment 1 and as described by Paclawskyj and Vollmer (1995).

Reinforcer test. The reinforcer tests were conducted in the same fashion as those in Experiment 1. The target behavior that was consequated with the HP stimulus was pressing a micro-switch. Adam, Burt, Edie, Gina, James, and Lester used a "One-Step" switch which was placed on the tray of their wheelchair in a spot that was easily accessible for each individual to reach with their hands. Kelly used a "Microlight" switch placed on her tray. The "Microlight" switch was used because it did not require her to lift her hand as high off of her tray as the "One-Step", and because it required less force to activate. Fran used a "Jellybean" switch which was attached to an apparatus on her wheelchair, and she pressed it with her head. The switches and placement of the switches used were consistent with how the participants used switches in their daily programs. The "One-Step" and "Jellybean" switches required 2-3 g of force to activate, and the "Microlight" switch required 1 g of force, according to the manufacturer.

Most of the participants received reinforcer test sessions of 15 min in duration. Due to

high rates of switch pressing, Edie had 15 min sessions for the first reinforcer test, and 5 min sessions for the last three tests. This was done in order to avoid satiation of the HP stimulus, and to reduce the sessions to a manageable length (approximately 30 min).

Within each A or B phase, the reinforcer tests were conducted using an ABAB design, which alternated between baseline (no consequence) and reinforcement (HP stimulus as a consequence) conditions. In instances where the results were unclear, a third AB replication was conducted. Participants were reinforced for switch pressing on an FR 1 schedule.

For Adam, the same stimulus (the teddy bear) was his most preferred stimulus for three out of the four preference assessments. The most preferred stimulus (feather boa) was used for the first test. The teddy bear was used for the second and third reinforcer tests. For the fourth test, the second most preferred stimulus was used, in order to maximize the likelihood that we would identify a reinforcer for him.

Reliability

Interobserver reliability and procedural integrity was measured and calculated using the same method as described for Experiment 1. As in Experiment 1, the observers were not informed of the hypotheses of the study, to control for experimenter bias.

Interobserver reliability. Interobserver reliability checks were conducted for 50% of the movement assessments conducted for Experiment 2. Reliability averaged 93% across all participants.

Interobserver reliability checks were conducted for 41% of all preference assessment sessions, across all participants, and averaged 100% (range 93-100%) for approach behaviors, 100% for avoidance behaviors, 95% (range 75-100%; 1 session below 80%) for happiness behaviors, 100% for unhappiness behaviors, 98% (range 80-100%) for no response, 91% (range

74-100%; 2 sessions below 80%) for response latency, and 96% (range 75-100%; 1 session below 80%) for engagement time. Interobserver reliability checks were also conducted for 38% of the reinforcer test sessions, and averaged 100% across all participants and conditions.

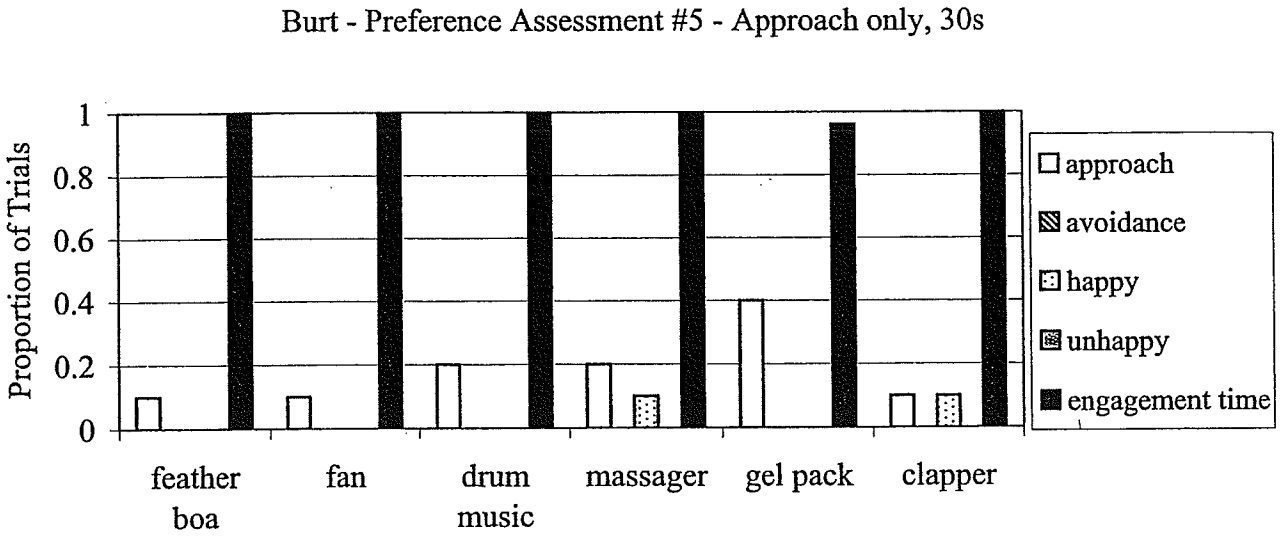
Procedural integrity. Procedural integrity checks were conducted for 41% of all preference assessment sessions, which averaged 100% (range 99-100%) across all participants. Procedural reliability checks were conducted for 38% of all the reinforcer test sessions, and averaged 100% across all participants and conditions.

Results

Determination of a Differential Stimulus Hierarchy

There was a large difference in the stimulus hierarchies between the two types of preference assessments when the response interval was 5 s versus 30 s. For the 5 s response interval, there was an average of 13 responses per assessment (out of a maximum of 60) across all participants. The amount of responding ranged from 0-9 responses per stimulus, with an average of 2 (out of a maximum of 10). For the 30 s response interval, there was an average of 24 responses per assessment. The amount of responding per stimulus ranged from 0-10, with an average of 4 (out of a maximum of 10). For an example of preference assessment data, see Figure 3. The data for all the participants is shown in Appendix I.

There were no unhappiness or avoidance responses for many of the participants. Adam, Burt, Edie, and Fran showed none of these responses across all four preference assessments, with a possible 240 opportunities to respond. Gina showed one unhappiness response, James showed six avoidance responses, and Kelly and Lester each showed one avoidance response across all preference assessments. Because of the infrequency of these responses, they were not useful in assessing preferences.



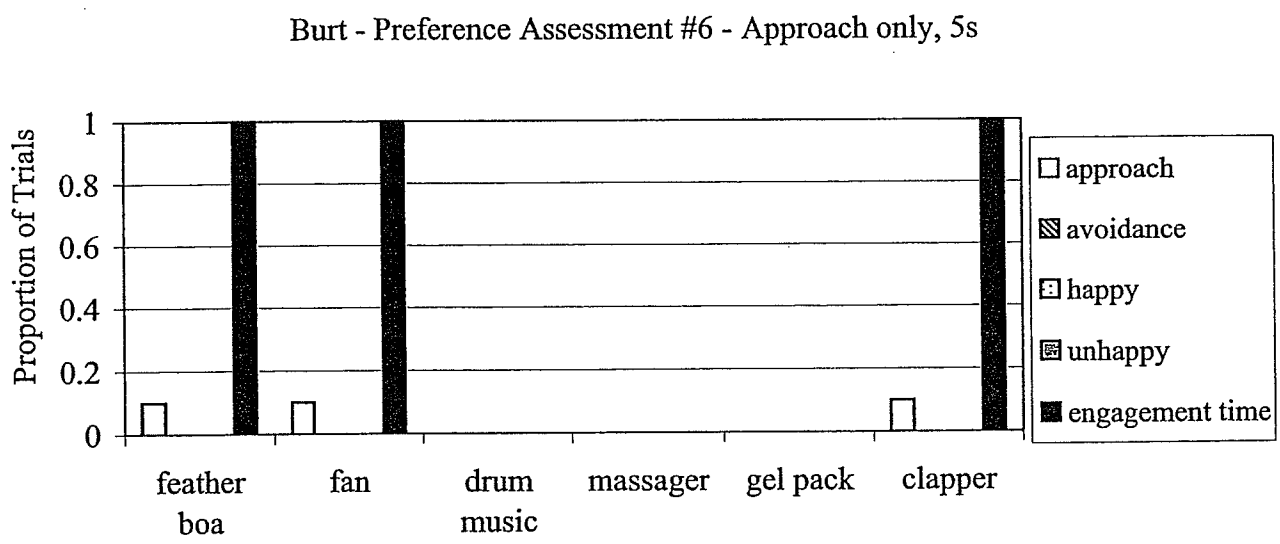


Figure 3. Sample preference assessment results for Experiment 2.

Engagement time was also not a useful measure of preference. Engagement with each stimulus involved different behaviors (looking, smelling, touching, listening) for each activity. The response effort for each of these behaviors is different, and for some stimuli (e.g., auditory and olfactory) the engagement time was 100%.

The preference assessments which used the 5 s response interval identified fewer HP stimuli than the preference assessments which used the 30 s response interval. However, just as in Experiment 1, neither type of preference assessment was very effective in identifying HP items according to Pace et al.'s (1985) 80% criterion (see Table 8). The preference assessments using the 5 s response interval identified four HP stimuli (1 for Edie and 3 for Gina), whereas the 30 s interval identified 20 (8 for Edie, 1 for Fran, and 11 for Gina). In cases where no HP stimulus was identified according to the Pace et al. definition, the stimulus with the highest percentage of responses was selected for the reinforcer test.

Response Latency

The average response latency of each participant in Experiment 2 was calculated for the trials in which a response occurred, averaging all responses that occurred in both 5 s and 30 s preference assessments. The average response latency was between 6 and 13 s for all participants except Edie, whose average latency was 4.28 s (see Table 9). This indicates that the 5 s response interval is too brief a period of time for most participants with PMD to be able to respond to a stimulus.

When the average response latency of each participant was compared with the movement assessment results, the latter were not very indicative of the response latencies that the participants were able to accomplish (see Table 9). Some participants, despite showing high levels of movement on the assessment, had very long response latencies, and these two measures

Table 8

Number of High Preference Stimuli Identified by each type of Preference Assessment in Experiment 2

	5s Response Interval		30s Response Interval	
Participant	Number of HP Stimuli Found*	Highest Approached Stimulus**	Number of HP Stimuli Found***	Highest Approached Stimulus***
Adam	0	40%	0	70%
Burt	0	10%	0	40%
Edie	1	90%	8	100%
Fran	0	40%	1	80%
Gina	3	90%	11	100%
James	0	40%	0	50%
Kelly	0	30%	0	60%
Lester	0	10%	0	40%

Note. * An HP stimulus is one that was approached on 0.8 or more trials. ** The highest proportion of trials that a stimulus was approached. *** An HP stimulus is one that was approached and/or evoked happiness on 0.8 or more trials. **** The highest proportion of trials that a stimulus was approached and/or evoked happiness.

Table 9

Average Response Latencies, Movement Assessment, BSID-II, and VABS scores

Participant	Average Response Latency	Movement Assessment	BSID-II Motor Scale Score*	VABS Motor Scale Score*
Adam	10.51	90%	<1 mo	<1 mo
Burt	12.62	90%	<1 mo	1 mo
Edie	4.28	92.5%	6 mo	16 mo
Fran	9.62	25%**	<1 mo	<1 mo
Gina	6.73	78%	4 mo	7 mo
James	7.30	100%	<1 mo	2 mo
Kelly	9.40	95%	<1 mo	<1 mo
Lester	9.60	32.5%**	1 mo	<1 mo

Note. BSID-II : Bayley's Scale of Infant Development - II (Bayley, 1993); VABS: Vineland Adaptive Behavior Scales (Sparrow et al, 1984). The BSID-II was administered as a teacher questionnaire, not as an actual test of the students' abilities. * Age-equivalent scores ** Minimal Movement

were weakly negatively correlated (-.194, p = .646). However, the participants' Motor Scale scores from the BSID-II (Bayley, 1993) and the VABS (Sparrow et al., 1984) were strongly negatively correlated with their average response latencies (BSID-II: -.821, p = .012; VABS: -.836, p = .010). Either of these two tests may be useful tools in deciding whether to choose a 5 s or longer response interval for future studies with persons with PMD.

Ivancic and Bailey (1996) reported that in their Experiment 2, there was a shorter response latency for those stimuli that were preferred in comparison with those that were less preferred. A similar analysis was conducted in the current study, and this effect was found, although the results were not statistically significant (see Table 10). The first column contains the correlations between the average response latency and average rank of each stimulus for all participants in Experiment 1. While the majority of the correlations were in the expected direction, only one (for Gina) was statistically significant.

The second and third columns in Table 10 contain the correlations between average response latency and the number of times each stimulus was the most preferred (or HP) stimulus and a reinforcer, respectively. The majority of the correlations in the two columns were in the expected direction, indicating that the stimuli that were the most preferred stimuli and were reinforcers a higher number of times were those stimuli that the participants responded most rapidly to during the preference assessments (negative correlation). However, the only one that was statistically significant (Fran) showed the opposite results. Fran showed a positive correlation, indicating that she was significantly slower in responding to stimuli which were the HP stimuli and reinforcers for her.

The final column in Table 10 contains the correlations between the average rank of each stimulus and the number of times that the stimulus was found to be a reinforcer for each

Table 10

Correlations between Response Latency, HP Stimuli, and Whether they were Reinforcers

	Average Response Latency & Average Rank	Average Response Latency & # of times it was HP	Average Response Latency & # of times it was a Reinforcer	Average Rank & # times it was a Reinforcer
Adam	.568	-.211	-.157	-.502
Burt	.380	-.359	--	--
Edie	.650	-.524	-.524	-.742, $p = .091$
Fran	-.491	.900, $p = .014$	.900, $p = .014$	-.473
Gina	.843, $p = .035$	-.501	-.703	-.599
James	.251	.280	--	--
Kelly	.737	-.539	-.126	-.058
Lester	-.519	.621	-.083	-.090

Note. All non-significant unless otherwise marked.

participant. All of the correlations were in the expected direction, but only one approached significance (Edie).

Reinforcer Test Results

The reinforcer test data obtained using an ABAB design was analyzed by looking at each set of 3 adjacent phases (ABA or BAB), and using the guidelines for the visual inspection of data outlined by Martin and Pear (2003), and as in Experiment 1. As in Experiment 1, the experimenter and two senior graduate students independently made decisions about whether there was a reinforcer effect in each ABA or BAB phase. The percent agreement was 91% for both comparisons.

Sample data for two participants is shown in Figure 4. From that data, it was concluded that the HP stimulus was not a reinforcer for Burt in either the ABA or the BAB comparison, however, the most highly preferred stimulus did function as a reinforcer for Fran in both comparisons. Individual data for all participants is shown in Appendix J.

Overall the most preferred items (HP or otherwise) for each participant and in each assessment were tested for their reinforcing value. The 30 s response interval was superior in identifying reinforcers when compared with the 5 s interval. Out of 34 aba/bab tests for each response interval, the 30 s response interval identified 13 reinforcers, while the 5 s response interval identified 10 reinforcers (see Table 11). Across all participants, and in at least one reinforcer test, the 5 s interval identified a reinforcer for 4 of the 8 participants, and the 30 s interval identified a reinforcer for 6 of the 8 participants (see Table 12). The 30 s interval was superior in identifying reinforcers, both in total, and on a per participant basis.

Those stimuli that were identified as HP were not consistently reinforcers when they were identified by the 5 s response interval or the 30 s response interval. For the 5 s interval,

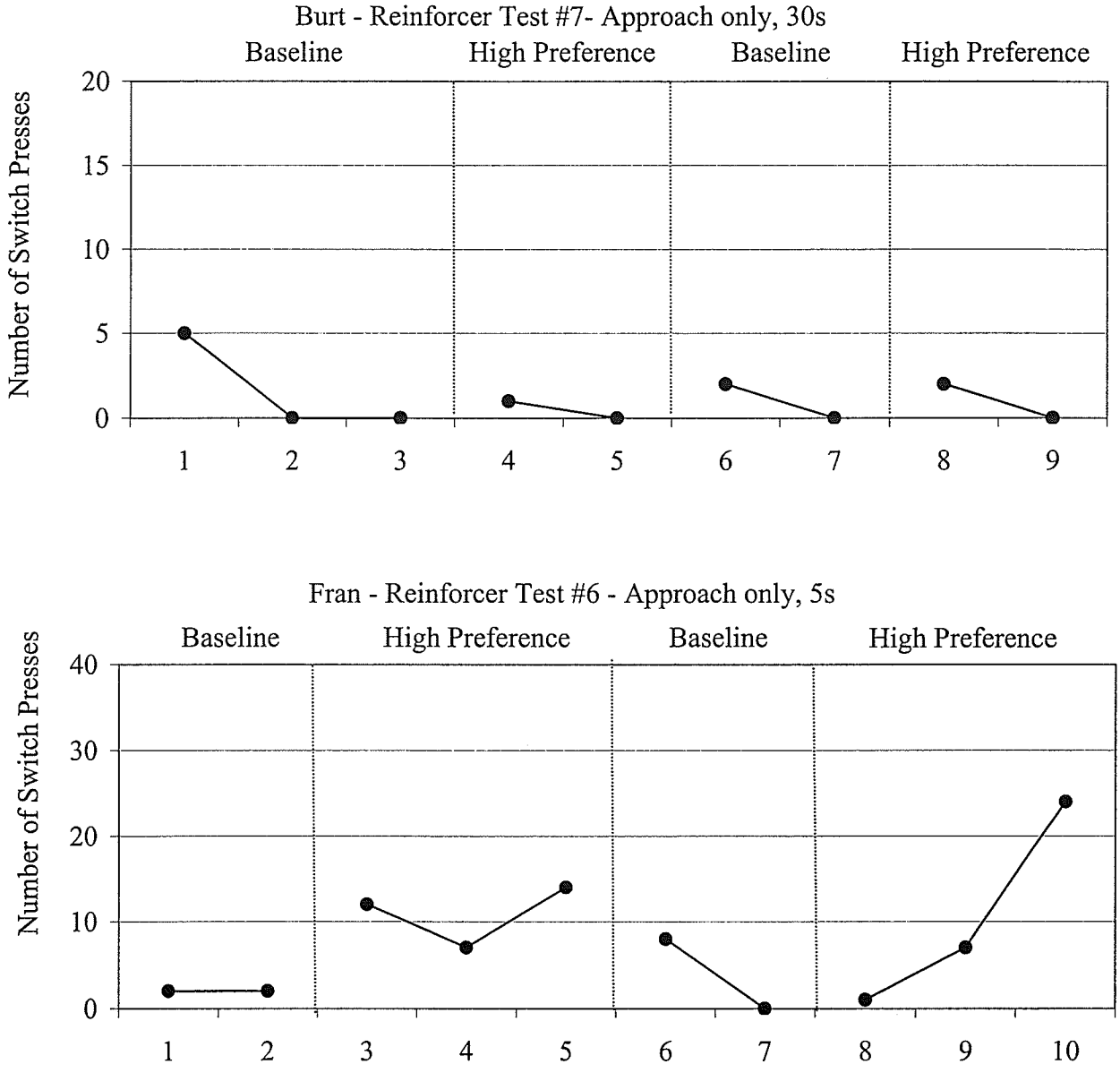


Figure 4. Sample reinforcer test results for Experiment 2.

Table 11
Summary of Results of Reinforcer Tests for Experiment 2

	Response Latency	
	5s	30s
Reinforcer found	10 (29%)	13 (38%)
No reinforcer found	24 (71%)	21 (62%)

Table 12

Summary of Results of Reinforcer Tests for Experiment 2 by Participant

	Were the Most Preferred Stimuli Reinforcers?			
	5s #1	5s #2	30s #1	30s #2
Adam	no, no	yes, no	yes, no	no, no
Burt	no, no	no, no	no, no	no, no
Edie	yes, no	yes, yes	yes, yes	yes, yes
Fran	yes, yes	yes, yes	no, no, yes, yes	yes, yes
Gina	no, no	no, yes, yes, no	yes, no	no, no
James	no, no	no, no	no, no	no, no
Kelly	no, no	no, no	no, no	yes, no
Lester	no, no	no, no	yes, yes	no, no

Edie and Gina each had one HP stimulus. When tested, the HP stimulus was not a reinforcer for Gina, and for Edie it was a reinforcer in the initial ABA comparison, but failed to replicate during the BAB comparison. For the 30 s interval, two HP stimuli were identified for each of Edie and Gina, and one for Fran. For Edie, both HP stimuli were reinforcers in all comparisons when tested. For Fran, the HP stimulus was not a reinforcer in the first two comparisons, but was a reinforcer in the two subsequent comparisons. For Gina, one HP stimulus initially was a reinforcer, but failed to replicate, and the second HP stimulus was not a reinforcer. Of the most highly preferred stimuli (responding <80%) identified by the 5s response interval, 9 out of the 30 tests discovered reinforcers. For the most preferred stimuli identified by the 30s response interval, 6 out of 22 tests discovered reinforcers (see Appendix J for all reinforcer test data).

Comparing the Teachers' Rankings with Preference Assessment Results

Before the first preference assessment was completed for James, Kelly and Lester, the teacher most familiar with a participant was asked to rank the stimuli according to what he/she felt that the participant's preferences were. For each participant this ranking was compared with the hierarchy produced by the first preference assessment completed by each participant. Overall, the teachers' rankings and preference assessment results were very poorly correlated (See Table 13). Of the 3 most preferred items identified in the first preference assessment (one for each participant), the teacher's rankings agreed for only 1 participant. Of the total of 2 reinforcers found for these participants, the teachers ranked neither of them as the most preferred stimuli for the participants.

Discussion

In Experiment 2, the average response latency (when the participants responded at all) in the preference assessments was 8.78 s. This is consistent with the research literature, which

Table 13

Correlations between the Teacher's Ranking of each Activity and the first Preference Assessment Conducted with each Participant in Experiment 2.

Participant	Activity	Teacher's Ranking	Assessment Ranking	Rank Correlation
James	disco ball	1	2.5	-0.441
	Lion King music	2	6	$p = 0.381$
	coffee scent	3	4.5	
	light toy	4	4.5	
	warm facecloth	5	1	
	massager	6	2.5	
Kelly	Lion King music	1	3	0.273
	fan	2	1	$p = 0.600$
	massager	3	6	
	coffee scent	4	3	
	mirror	5	5	
	light toy	6	3	
Lester	Lion King music	1	1.5	0.463
	disco ball	2	5	$p = 0.355$
	massager	3	1.5	
	teddy bear	4	5	
	gel pack	5	3	
	hazelnut scent	6	5	

discovered that many individuals with PMD take a long time to respond to stimulus presentations (Logan & Gast, 2001). This indicates that a 5 s window of opportunity to respond in a preference assessment may be too short for many individuals with PMD to show their preferences. There was much more responding during the 30 s interval, and more reinforcers were discovered than during the 5 s interval.

One argument against longer response intervals may be that the participants might respond faster to those stimuli that are strong reinforcers, and therefore any responses that occur within the 5s interval will be limited to those stimuli that are strong reinforcers. However, on average, the participants did not respond more rapidly in the preference assessments to stimuli which were discovered to be reinforcers. Therefore, the longer response interval will give the participants more time to be able to express their preferences.

There were no significant differences in the ease or difficulty of finding reinforcers for those individuals with minimal movement in comparison to those with higher levels of movement. Participants both with and without minimal movement had long response latencies, and it was difficult to identify reinforcers for all of them. The BSID-II and VABS Motor Scale scores were both correlated with the participants' response latencies, and these tools would be useful in the future for determining whether a 5 s response interval is long enough for the participants to reliably be able to respond to a stimulus, or if a longer response interval should be used.

General Discussion

In Experiment 1, it was found that the approach and/or happiness and approach only response definitions were approximately equally effective in identifying reinforcers for individuals with PMD. In Experiment 2, it was found that a 30 s response interval was more

effective in identifying reinforcers when compared with a 5 s response interval for individuals with PMD.

It is possible that Pace et al's (1985) 80% criterion for selecting potential reinforcers from the results of a single-stimulus preference assessment may be too strict for individuals with PMD. Across the two experiments, stimuli that were found to be reinforcers were responded to from 10% to 100% of preference assessment trials. In comparison, stimuli found not to be reinforcers were responded to from 10% to 100% of preference assessment trials. Using the 80% criterion, and combining the results from Experiments 1 and 2, there were 11 true positives (HP stimuli correctly identified as potential reinforcers), 67 true negatives (stimuli correctly identified as not being reinforcers), 9 false positives (HP stimuli incorrectly identified as being reinforcers), and *49 false negatives* (stimuli incorrectly identified as not being reinforcers). Thus, especially for individuals with PMD, for whom it is difficult to find any reinforcers, the 80% criterion is too strict, causing us to miss out on the opportunity to identify many reinforcing stimuli.

If the criterion were changed to 50% for individuals with PMD, then there would be 32 true positives, 36 false positives, 40 true negatives, and only 26 false negatives. This criterion correctly identifies more of the reinforcers that were discovered, while still correctly discounting many stimuli as not being reinforcers. It is expected that there will always be some degree of error in using preference assessments to identify reinforcers, but the 50% criterion is more accurate in correctly identifying preferred stimuli as potential reinforcers than Pace et al's (1985) 80% criterion. More research using larger sample sizes will help to determine the most effective criterion.

Overall, there were very few unhappiness and avoidance responses during the preference assessments. This is not surprising considering that the 6 stimuli that were tested for each

participant were those to which a participant showed the most positive responses during an initial presentation of 15-20 stimuli. Therefore, unhappiness and avoidance behaviors were not useful in determining the preference hierarchy for these preference assessments. However, if a preference assessment was conducted with stimuli that were completely novel, and it was not known how the participants might react, then occurrences of unhappiness and avoidance behaviors might be useful information in determining preferences.

Across the two studies, the teacher's rankings of the stimuli were poorly correlated with the preference assessment results of the most preferred items and reinforcers for all participants. This is consistent with previous research, in that subjective opinions are not as accurate as direct assessments. However, when just the two most preferred stimuli identified by the preference assessments were considered, the teachers identified 14 out of 22 stimuli as being one of the participants' two most preferred stimuli. This is more accurate than the correlations indicated, and may mean that the teachers are more accurate at identifying highly preferred stimuli, and less accurate in identifying less preferred stimuli. Preference assessments appear to remain more accurate than subjective impressions in identifying stimuli that may be reinforcers for these individuals. However, future research should conduct a reinforcer assessment with the stimuli that the teachers identified as the most preferred, to determine whether those stimuli were reinforcers in addition to the ones identified by the preference assessments.

Overall, there were not many reinforcers found. This is consistent with the literature. Previous studies with this population have also had trouble finding reinforcers for these individuals (Ivancic & Bailey, 1996; Logan & Gast, 2001).

How can we make it more likely that we will find reinforcers for individuals with PMD? The current studies only included 6 stimuli in each preference assessment, individually selected

for each participant. Future studies should try and include more stimuli in the preference assessment, in order to maximize the chances for finding a reinforcer.

There may be different types of activities that were not tested that may be reinforcers for these individuals. The activities selected for these studies were easy to present sitting in a room at a table. There may be other reinforcing activities that were not included because they were not so easy to present (e.g., watching TV, being pulled in a wagon, sitting on a swing, being pushed in a wheelchair through a park). Activities such as these might be reinforcers for these individuals.

Another possibility is that the stimuli were presented for too short a time in order for them to be reinforcing. The stimuli were presented for 15s during both the preference assessments and reinforcer tests. These participants had very long response latencies, and it may be that 15s was not long enough for the participants to react to or properly enjoy the activities. As well, it may be that some activities are more reinforcing when they are presented for a longer time (e.g., hearing an entire song vs. 15s of the song).

One limitation of this study was that the reinforcer tests took a long time to complete. The reinforcer tests in Experiment 1 took an average of 9 weeks (range 4-22 weeks) to complete, while the reinforcer tests in Experiment 2 took an average of 10 weeks (range 3-24 weeks) to complete. This was due to scheduling difficulties for some of the participants, as well as unexpected delays caused by illness or participants falling asleep during sessions. It is entirely possible that the participants' preferences changed during that time, so that while a stimulus may have been a reinforcer at the time that the preference assessment was conducted, it was no longer so by the time the reinforcer test was completed. In fact, there were 9 instances across the two studies where the stimulus was a reinforcer for the first ABA assessment, and yet was not for the

following BAB assessment. Future studies should consider ways to conduct reinforcer tests in a briefer fashion, both to maximize the chances of discovering reinforcers, and to make this tool accessible to staff members, who may not have the time to conduct a reinforcer test during sessions scattered over 9 weeks.

During the evaluation of the preferred stimuli as reinforcers in the ABAB design, there were no programmed consequences for switch pressing in the A phases, which have been referred to as extinction baselines. Logan et al. (2001) recommended not using extinction baselines because the individuals in their studies tended to have an extended recovery time during reinforcement sessions that followed extinction baseline sessions. This may interfere with the results of the reinforcer test, because the experimental sessions may not continue long enough for their responding to recover and show a reinforcer effect. An example of this can be seen in James' pattern of responding: his rates of switch-pressing steadily decreased across the course of the study (see Figure J6). As well, switch-pressing is a behavior that these individuals use to communicate with caregivers and to activate leisure items in their daily programs, and it is counter-productive to decrease a behavior that is so useful and that the teachers have worked so hard to establish. One example of a study that did not use extinction baselines is Spevack, Yu, Lee and Martin (in press). They alternated between high preference and low preference stimuli and were able to show reinforcer-like effects without an extinction condition. Thus, future studies with individuals with PMD should consider alternatives to extinction baselines for examining stimuli as reinforcers.

Logan et al. (2001) also recommended that discrete trials, such as those conducted in the reinforcer tests in this study, are artificial, and do not necessarily reflect how people typically interact with stimuli in the environment. They recommended trying free operant responding or

other designs, to determine if these will be more effective in discovering reinforcers for these individuals.

Another possibility for future researchers to consider when designing a reinforcer test for individuals with PMD and/or minimal movement skills is to use a behavior other than the typical switch-pressing response used in this and many other studies. This study required a participant to press a micro-switch with either his/her hand or head. For some participants, this response was very effortful, and may have limited the amount of responding that they could emit. Lancioni et al. (in press) used a chin movement response (similar to a chewing motion) for two participants, and were able to demonstrate a reinforcer effect for both participants. Spevack et al. (in press) used a looking response as the target behavior for their reinforcer tests, and were able to show a reinforcer effect when one had not been demonstrated using the same stimuli as a consequence for a more effortful switch-pressing response. Future research should examine different types of target behaviors which require less effort to perform that can be used with individuals with PMD.

In summary, this study investigated two procedural parameters to determine which way of conducting a single-stimulus preference assessment would be the most accurate in identifying reinforcers for individuals with PMD. This was the first study to assess only non-edible stimuli. The first experiment found that the preference assessments which used the approach response definition were approximately as effective in identifying reinforcers as the assessments which used the approach and/or happiness response definition. The second study found that the 30s response interval was more effective in identifying reinforcers when compared with the 5s response interval. Identifying the most effective preference assessment method is important, because it allows us to identify reinforcers for teaching programs, and to increase the quality of life for individuals with PMD.

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Appendix A

Project Description and Consent to Participation Form

Research Project Title:	Assessing Stimulus Preferences and Testing for Reinforcing Effects of Stimuli in Children with Profound Multiple Disabilities
Researcher:	Sara Spevack, M.A. ( ) and Dr. Garry Martin (474-8589)
Affiliations:	St. Amant Centre and University of Manitoba
Sponsor of Research:	Canadian Institutes of Health Research

This description, a copy of which will be left with you for your records and reference, is only part of the process of informed consent. It should give you the basic idea of what the research is about and what participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to ask. Please take the time to read this carefully and to understand any accompanying information.

What is the purpose of the study?

For many persons with multiple disabilities, it is difficult to identify activities that are rewarding for them and that can increase their quality of life. This is especially so for those who are unable to speak and have difficulties in moving. We will be studying the best way to conduct a preference assessment with these individuals, to identify highly preferred items that can increase their quality of life. We will also be using that activity as a reward for a particular behavior (e.g., switch pressing), to determine if these highly preferred items can be used as reinforcers for teaching the participant new skills.

What are the study procedures and how long will the study take?

We will:

1. Interview staff members familiar with the participant to identify possible preferred activities, and to ensure that the activities are safe for the participant to do.
2. Conduct a preference assessment with a variety of activities.
3. Observe the participant to determine if happiness, approach responses, or engagement time are the best way to measure preferences for different activities.
4. Use the most preferred activity as a reward for a particular behavior (e.g., switch pressing) to see if it will function as a reinforcer.
5. Videotape the sessions so that we can check the reliability of our procedures at a later time. (Note: we welcome your participation even if you do not wish the participant to be videotaped.)

Sessions will be scheduled at the participant's convenience. The study will be completed over a period of one year.

Will the participant's personal information be kept confidential?

All information obtained about the participant will be handled in compliance with Section 24 of the Personal Health Information Act (PHIA). All information will be kept confidential and stored in a locked office. Only the research staff will have access. Any presentations, reports, or publications about the project will not contain any identifying information. The information will be kept for up to five years after the completion of the study and will then be destroyed in a confidential manner.

What are the risks and benefits in taking part in the study?

The procedures of this study present no risks to the participant beyond what he/she might encounter in everyday activities.

Participants will benefit directly in that we will learn what activities the participant likes best. With your permission, this information will be shared with authorized St. Amant staff. Finally, our experience in past studies is that participants typically enjoy the one-to-one interactions during research sessions.

Will I receive the results of the study?

If you wish to be informed of the results, please check YES in the appropriate box at the end of this form and we will send you a summary of the findings within approximately 3 months after the completion of the study.

Is there any payment or cost for participating?

There is no financial compensation or cost to take part in the study.

Is participation voluntary?

Participation is voluntary. Whether you give consent for the participant to take part in the study will in no way affect any services you or the participant may be receiving now or in the future from St. Amant Centre or from the University of Manitoba.

Moreover, even after you give consent, you can stop any time and for any reason by simply calling the principal investigator listed at the end of the consent form. Again, your decision to stop will not affect any services you or the participant may be receiving now or in the future from St. Amant or the University of Manitoba.

Lastly, the cooperation of the participant to continue in this study (e.g., their willingness to come to a session and to work with the research project staff) will be monitored throughout the study. If at any time the participant is unwilling to come to the session or wishes to leave during a session, that decision will be respected and the session will be cancelled/rescheduled. If this happens on a continual basis (e.g., several times in a row), we will accept this as a possible indication that the person does not wish to continue and discontinue his/her participation from the project. We will discuss this with you before the decision is made.

Will I be contacted in the future for other studies?

The results of this research may lead to other related studies in the future that may be beneficial to the participant. Please check the appropriate box at the end of this form if you would like to be contacted directly by the researchers in the future about other studies.

Signing the Consent Forms

Signing the following page of this *Project Description and Consent Form* indicates that you have understood to your satisfaction the information regarding participation in the research project and agree for the participant to participate as a subject. In no way does this waive your legal rights nor release the researchers, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time, and/or refrain from answering any questions you prefer to omit, without prejudice or consequence. Your continued participation should be as informed as your initial consent, so you should feel free to ask for clarification or new information throughout your participation.

Principal Investigator:	Sara Spevack, Phone:
Research Program Manager:	Toby Martin, Phone:
Coinvestigator:	Dr. Dickie C.T. Yu, Phone: 256-4301, x399
Coinvestigator:	Dr. Garry Martin, Phone: 474-8589

The Psychology/Sociology Research Ethics Board has approved this research. If you have any concerns or complaints about this project, you may contact any of the above-named persons or the Human Ethics Secretariat at 474-7122. A copy of this Project Description and Consent Form has been given to you to keep for your records and reference.

Signatures

I _____, here by:
(please print your name)

☐ consent to _____'s participation in this study.
(please print participant's name)

☐ **do not** consent to participation.

By giving consent I allow the research project staff to:

- Work with the participant in one-to-one sessions, approximately 3 half-hour sessions per week.
- To obtain personal health information, including: age, diagnosis, level of functioning, previous intellectual and adaptive behavior assessments, and physical and sensory difficulties from the health records at St. Amant Centre. **A separate *Consent to the Release of Personal Health Information* form has been included for this purpose. Please complete and sign that form and return it along with this consent form.**
- Include the participant's results in publications, reports, and talks, so that others may learn from this project. The identity of the participant, however, *will not* be disclosed.

I understand that I can revoke or amend this consent at any time and for any reason. The consent will otherwise remain in effect for a period of 12 months from the date it is received.

Please check YES or NO for the following items:	YES	NO
• I would like to receive the results of this study.		
• I allow the researchers to share the participant's results with authorized St. Amant staff.		
• I allow the researchers to contact me directly for possible future related studies.		
• I allow the researchers to share the participant's results with another individual or individuals (e.g. family members). (*Please attach name and mailing address for each individual.*)		
• I allow the researchers to videotape some sessions to improve their observations.		

_____ _____
Signature of Individual **Date**

_____ _____ _____
Name of Researcher/Delegate **Signature of Researcher/Delegate** **Date**

Please return all 4 pages of this *Project Description and Consent to Participation Form* and the *Consent to the Release of Personal Health Information Form* in the enclosed stamped envelope.

St. Amant Centre
Centre St-Amant

ACCESS AND/OR CONSENT

TO THE RELEASE OF PERSONAL HEALTH INFORMATION

I _____ here by:
(Name of Individual - *please print*)

☐ request access to my personal health information (PHI) →
☐ request access to the PHI of the individual stated below →

_____ / _____
SIGNATURE ***DATE***

☒ authorize the St. Amant Centre to disclose the following information:
- age, diagnosis, level of functioning, previous intellectual and adaptive behavior assessments, and physical and sensory difficulties

(Description of information to be accessed or disclosed)

to St. Amant Research Program; 440 River Rd. R2M 3Z9; 204.256.4301 x438 from the records of
(Name, address and telephone – TO BE COMPLETED FOR INDIVDIUAL REQUIRING CONSENT)

_____, _____, *(This field is not needed.)*
(Name of individual in full) **(Date of birth)** **~~(Manitoba Health / Personal Health Info. No.)~~**

for the purpose of: *(Optional for individual making request)* Participating, or potentially participating, in the project: *Assessing stimulus preferences and testing for reinforcing effects of stimuli in children with profound multiple disabilities.*

Legal authority for request/authorization: Self ☐ Parent/Guardian ☐ CFS Order ☐ SDM ☐ Committee ☐

I acknowledge that I have been advised of the reason that the personal health information is needed, and of the risks and benefits of consenting or refusing to consent to disclosure of same.

_____ _____
(Signature of Individual) **(Date)**

_____ _____
(Signature of Witness) **(Date)**

- The recipient of the information will be instructed not to use or disclose the above information except as consented to herein.
- This consent may be revoked or amended at any time.
- This consent will remain in effect for a period of 60 days from the date to which it is received.

OFFICE USE ONLY

You will be contacted within 30 days of the receipt of your request. At that time, the availability of the information will either be confirmed to you or you will be informed that your request cannot be granted. If the information is available you will be charged a processing fee of _____ to access the information. If you are requesting a copy, the cost will be _____ per page for photocopies.

TO BE FILLED OUT BY PRIVACY OFFICER

SIGNATURE		***DATE RECEIVED***	

REVISED: NOVEMBER 2002

Appendix B

The Bayley Scales of Infant Development – II – Caregiver Interview Protocol

Client's Name Informant's Name Date

Mental Scale

1. Can <x> focus on you for at least 2 s?

nonth

2. When <x> is fussy, does he/she calm down when picked up/touched/cuddled?
3. Does he/she clearly respond (turn her head/eyes, vocalize, change activity level or facial expression) to your voice when he/she cannot see you?
4. Does he/she visually explore his/her surroundings?
5. Does <x> follow a moving person with his/her eyes?
6. If you hold something approximately 8 inches above his/her eyes, can he/she look at it for 3s?
7. If a new sound is happening in the room, does he/she get used to it quickly?
8. Would <x> be able to discriminate between that sound and a new sound?
9. Will <x> search with his/her eyes for a sound that is out of his/her field of vision?
10. Can <x> vocalize 4 times in an hour?
11. Does <x> show anticipatory excitement when caregivers go to lift, feed, or dress him/her?
12. Does <x> show anticipatory body adjustment when caregivers go to lift him/her?

months

13. Does <x> visually recognize caregivers?
14. Does <x> smile when you speak to him/her?
15. Can <x> follow an object that is moved horizontally in front of him/her with his/her eyes?
16. Can <x> follow an object that is moved vertically in front of him/her with his/her eyes?
17. Can <x> follow an object that is moved in a circle in front of him/her with his/her eyes?
18. Can <x> follow an object that is moved in an arc in front of him/her with his/her eyes?
19. Does <x> smile when you smile at him/her?

months

20. Does <x> react when caregivers move out of his/her visual range?
21. Does <x> vocalize when you speak to him/her?

{1 month end here}

22. Can <x> vocalize two different vowel sounds (a, ah, uh, oo, ee, eh)?
23. If you hold two objects in front of <x>, will he/she look at both of them?
24. Can <x> turn his/her head sideways to follow an object you are showing him/her?
25. If you put an object on his/her tray, will he/she look at it for 3s?
26. Does <x> get bored of looking at a new picture quickly?
27. If you then show him/her a different picture, will he/she look at it again?
28. Does <x> prefer to look at more complex pictures?
29. Does <x> spend more time looking at new pictures compared with familiar pictures?

l months

30. Can <x> turn his/her head toward a sound that is presented to one side of his/her head but out of sight?

31. Does <x> have different sounds that he/she makes when in different moods?
32. If you roll a ball across his/her tray, can he/she follow it with his/her head or eyes?
33. Does <x> vocalize when you smile at his/her?
34. Does he/she visually inspect his/her own hands?
35. If you gave him/her a rattle, would he/she interact with it (look, feel, play – only grasping does not count)?
36. Would he/she be able to follow a rod passed in front of him/her with his/her eyes?

{2 months end here}

37. Would he/she be able to manipulate a small object if you put in his/her hand?
38. If you were to dangle an object in front of him/her, would he/she be able to reach for it?
39. If you were to dangle an object in front of him/her, would he/she be able to grab it?

{3 months end here}

40. If you were to put an object in his/her hand, would he/she be able to bring it to his/her mouth?
41. If you were to put a mirror in front of <x> so he/she could see him/herself, would he/she approach it with his/her head, body or hands?

months

42. If you were to put a cube within reach, would he/she reach for it?
43. If you were to put a cube just beyond reach, would he/she persistently reach for it?
44. If you were to put a cube within reach, would he/she be able to touch it on purpose?
45. If you were to put a cube within reach, would he/she be able to pick it up within 3 tries?
46. If something the child is looking at disappears behind another object, would they look at the spot where it disappeared for 2s?
47. Does <x> display awareness of novel surroundings?
48. If you were to dangle a string in front of <x>, would he/she play with it?

months

49. If you put a mirror in front of him/her, would he/she smile at his reflection?
50. If you put a mirror in front of him/her, would he/she laugh, touch it, bang it, etc?
51. If you were to place a small candy in front of him/her, would he/she attend to it?

{4 months end here}

52. If you were to give him/her a toy or spoon, would he/she bang with it?
53. If you were to place several cubes in front of him/her, would he/she grab one, then another?

months

54. Can <x> transfer an object from one hand to the other?
55. If you were to hide a small toy under a cup while <x> is watching, would he/she lift the cup to find it?
56. If an object falls off the table while <x> is watching and makes a loud noise, would he/she turn and look for it?
57. If you were to place several cubes in front of him/her, would he/she have good eye-hand coordination when grabbing one?
58. If you were to place several cubes in front of him/her, would he/she grab and hold two cubes for 3s?

months

59. If you gave him/her a bell, would he/she be able to manipulate it and look with interest at its details?

60. If you were to scribble on a paper in front of <x>, would he/she watch you?
61. Can <x> say 3 different vowel sounds (a, ah, uh, oo, ee, eh)?

months

62. If you gave him/her a ring with a string on it, could he/she pull the string to bring the ring to him/her?
63. Can <x> imitate you when you make sounds?

months

64. Can <x> participate in a game of peek-a-boo with you?
65. If the child is holding 2 cubes, can he/she hold on to those 2 for 3s while looking at a third? *{5 months end here}*

months

66. Can <x> hold a bell by the handle and purposefully ring it?
67. If you were to hide a small toy under a cup while <x> is watching, would he/she lift the cup by the handle using one hand to find it?
68. Does <x> use gestures to make his/her wishes known?
69. If you show <x> a picture book, will he/she look at or touch the pictures?
70. Will <x> listen selectively to two familiar words?

2 months

71. Can <x> repeat vowel-consonant combinations (e.g. ba-ba-ba or da-da)?
72. If you put something into a box in front of the child, then remove it when the child is not looking, will the child look into the box for it?

{6 & 7 months end here}

73. Can <x> turn the pages of a book?
74. Can <x> put a cube into a cup after you demonstrate doing it?
75. If <x> has one block in each hand, and a third is presented, will he/she attempt to pick up the third as well?
76. Does <x> show expressive inflections in his/her speaking?
77. If you demonstrate pushing a car, could <x> then push the car?

(up to the end of 12 months)

Basal Rule: Mental Scale 5+ credited items, Motor Scale 4+ credited items per section
Ceiling Rule: Mental Scale 3+ no credit items, Motor Scale 2+ no credit items per section

Motor Scale

1. Will <x> thrust his/her arms?
2. Will <x> thrust his/her legs?
3. Can <x> lift his/her head independently?
4. Can <x> hold his/her head erect for 3s?
5. When <x> is held upright, can he/she adjust his/her body position?
6. Are <x's> hands fisted most of the time?

month

---

7. Can <x> hold his/her head erect & steady for 15s?
8. When <x> is lying down, can he/she lift his/her head at least a little?
9. Can <x> hold his/her leg up for 2s?
10. Does <x> make any crawling movements with his/her body?

months

---

11. Can <x> turn from his/her side to back?
12. Does <x> attempt to put his/her hand in his/her mouth?
13. Can <x> hold on to a small object for 2s?
14. If <x> is held face down, could he/she hold his/her head up so it is level with his/her body?
15. When he/she is being moved from one place to another, can he/she hold his/her head steady?
16. Is <x> able to make symmetrical movements of his/her arms or legs?

months

---

17. When <x> is lying down, is he/she able to hold his/her head roughly centered to his/her body?

{1 month end here}

18. When <x> is lying down, can he/she lift him/herself up using his/her arms?
19. If <x> is tilted at an angle, is he/she able to hold his/her head balanced?
20. If <x> is lying on his/her stomach, can he/she lift his/her head up 45 degrees (& lower with control)?

{2 months end here}

21. Can <x> sit with support?
22. Can <x> sit with slight support for 10s?
23. Are <x's> hands open most of the time when he/she is doing their own thing?
24. If <x> is lying on his/her stomach, can he/she lift his/her head up 90 degrees (& lower with control)?

months

---

25. When <x> is lying on his/her stomach and is supporting his/her weight with arms, can he/she shift his/her weight from one arm to the other?
26. Can <x> turn from his/her back to the side?
27. Can <x> rotate his/her wrist when manipulating an object?

months

---

28. Can <x> sit alone for 2s?

{3 months end here}

29. Can <x> use his/her whole hand to grasp a rod?
30. When there is an object within reach, will <x> tend to reach for it with one (credit) or both (no credit) hands?

31. Can <x> use partial thumb opposition to grasp a small object?
32. If you put a small candy in front of <x>, would he/she attempt to grab it?
33. When <x> is lying on his/her back, can he/she grab your hands to pull him/herself into a sitting position?
34. Can <x> sit unsupported for 30s? *{4 months end here}*

nonths

35. Can <x> sit unsupported for 30s while playing with a toy
36. Can <x> sit unsupported steadily with his/her back fairly straight?
37. Can <x> use his/her thumb & fingertips to pick up a small object?
38. Can <x> turn from his/her back to stomach?
39. Can he/she grasp his/her foot with hand(s)?
40. If <x> is held with his/her feet just touching the floor, will he/she make stepping movements?

{5 months end here}

41. If you were to place a small candy in front of <x>, would he/she be able to use his/her whole hand to pick it up?

nonths

42. When <x> is lying on his/her back, does he/she attempt to sit up independently?
43. When <x> is sitting on the floor, could he/she independently move forward 9 inches (creeping/crawling/on her stomach/ quadrupedal/hitching)?
44. If <x> is held standing, can he/she support his/her weight for 2s, using your hands only for balance?
45. When <x> is lying on his/her back, can he/she grab your hands to pull him/herself into a standing position?
46. When <x> is standing, will he/she lift at least one foot off the floor?
47. Can <x> use a chair/table leg/etc to pull him/herself into a sitting position?

{6 months end here}

48. If <x> was holding one object in each hand, could he/she bang them together in the middle?

) months

49. If you placed a small candy in front of him/her, could she use his/her thumb & fingers to pick it up?
50. When <x> is sitting unsupported, can, he/she rotate his/her upper body to reach for something? *{7 months end here}*

) months

51. Can <x> move from a sitting to a creeping position?
52. Can <x> raise him/herself into a standing position using a chair/table leg/ etc?
53. Does <x> attempt to walk when he/she's standing?

months

54. Can <x> walk sideways while holding on to furniture?
55. When <x> is standing, can he/she sit down on purpose?
56. If you were to put a small candy in front of <x>, could he/she pick it up with his/her fingertips?
57. Could <x> pick up a rod by at least partially opposing his/her thumb to the fingers?

months

58. If you were to give <x> a pencil with the pointy end away from him/her, could he/she pick it up by the end closest to him/her?
59. If <x> is lying on his/her back, could he/she stand up if you requested it?

{8 months end here}

60. Can <x> walk supported?

(up to the end of 12 months)

Basal Rule: Mental Scale 5+ credited items, Motor Scale 4+ credited items per section
Ceiling Rule: Mental Scale 3+ no credit items, Motor Scale 2+ no credit items per section

Appendix C

Movement Assessment Data Sheet

Name: Primary Observer: Date:

Activity: IOR: Time:

Setting: Session:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Awake?																				
movement																				
minute body movement																				
eyelid movement																				
involuntary responses																				

Appendix D

Pre-Determined Random Order for Presentation of Stimuli in the Preference Assessments

<name> - preference assessment #X - <response definition>, <response interval>

Order in which to present stimuli:

Trial:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
4	3	6	2	5	2	4	1	5	2	1	5	4	2	3	1	3	6	5	4
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
3	1	6	5	4	2	5	4	5	6	2	1	6	2	3	4	3	1	6	2
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
1	2	3	4	6	3	5	1	5	4	6	1	6	3	2	1	5	4	3	6

Stimuli:

1 _____
2 _____
3 _____
4 _____
5 _____
6 _____

Appendix E

Preference Assessment Data Sheet

Preference Assessment

Name:

Primary Observer:

IOR:

Date:

Time:

Response Definition: approach only / approach or happiness

Response Interval: 5s / 30s

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Stimulus:																				
Approach																				
orient to activity																				
reach																				
manipulate item																				
nodding																				
Avoidance																				
decline/push/drop																				
turn/pull away																				
Happiness																				
smile																				
giggle/laugh/noise/bang																				
Unhappiness																				
frown/grimace																				
unhappy noises/ crying																				
SIB/tantrum/banging																				
No Response																				
Response Latency																				
Engagement Time																				
Procedural Reliability																				
correct response definition																				
correct response interval																				
randomly alternate stimuli																				
correct presentation																				
correct verbal prompt																				
remove if unhappy																				

Appendix F

Reinforcer Test Data Sheet

<name> FR 1 response - 5 or 15 minute session - 15 sec reinforcement

Date	Observer	Condition	Start Time	End Time	Response Time	PR (y/n)
			00.00.00			

Appendix G

Preference Assessment Results for all Participants in Experiment 1

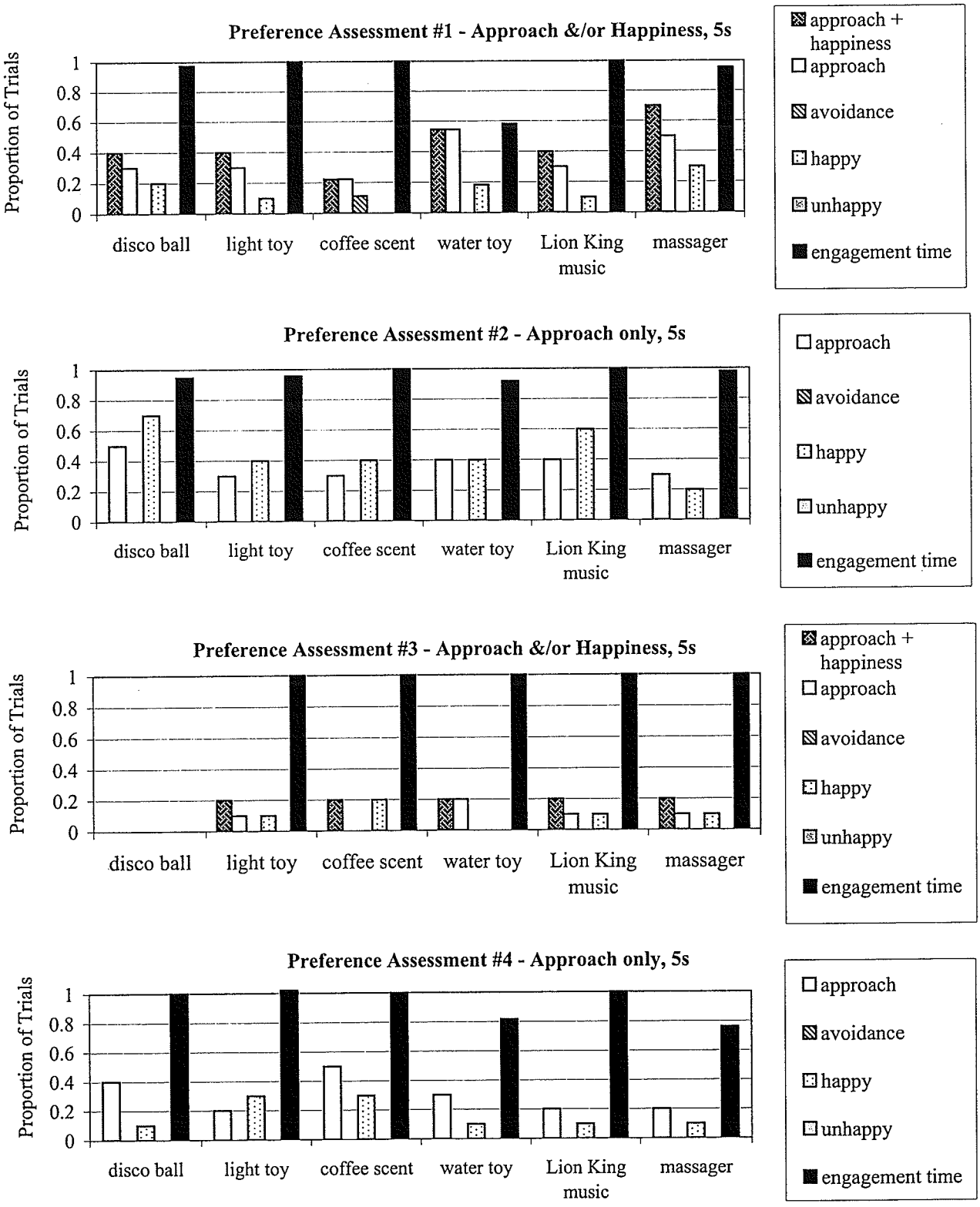

Figure G1. Preference Assessment Results for Adam (Experiment 1).

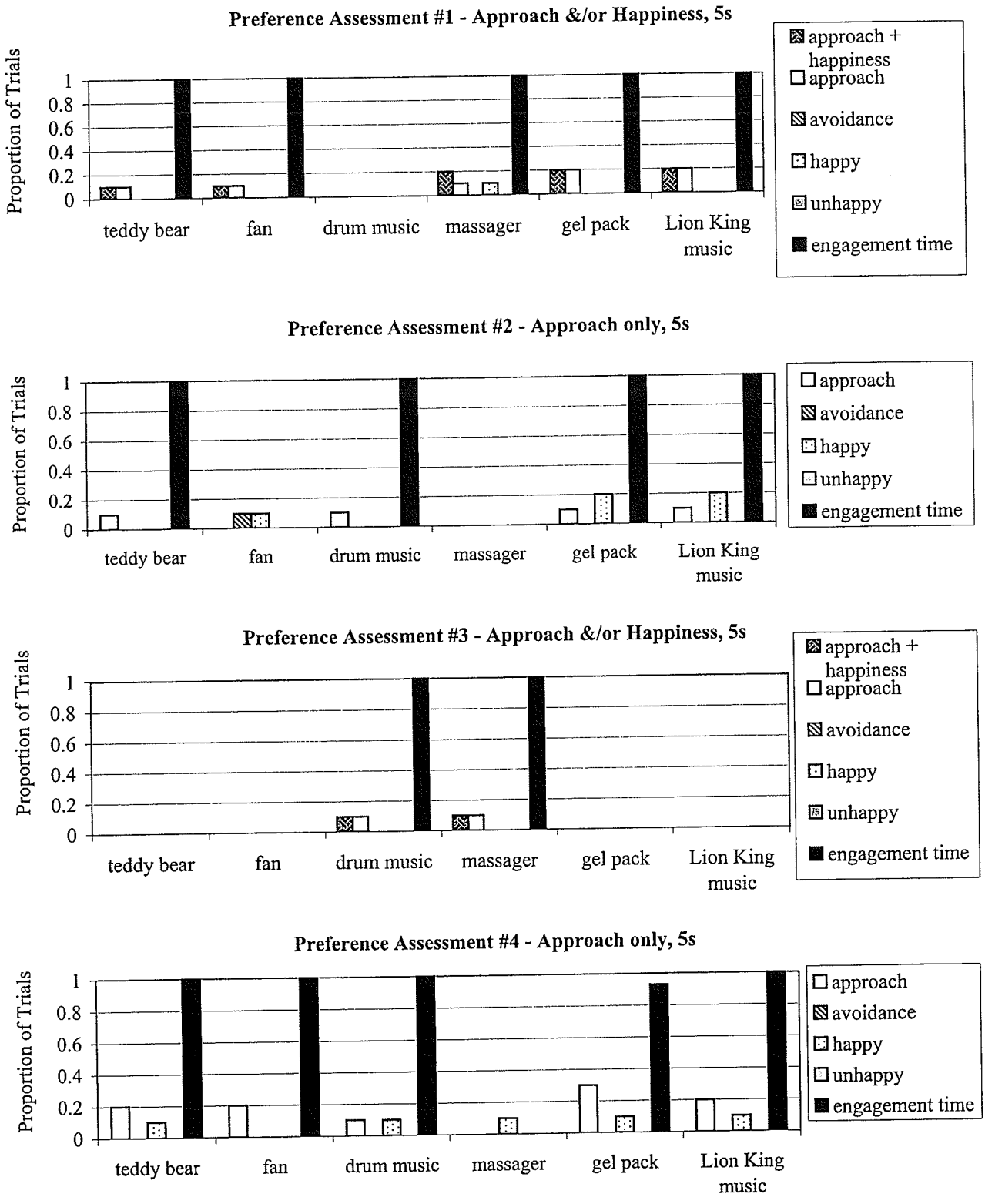

Figure G2. Preference Assessment Results for Burt (Experiment 1).

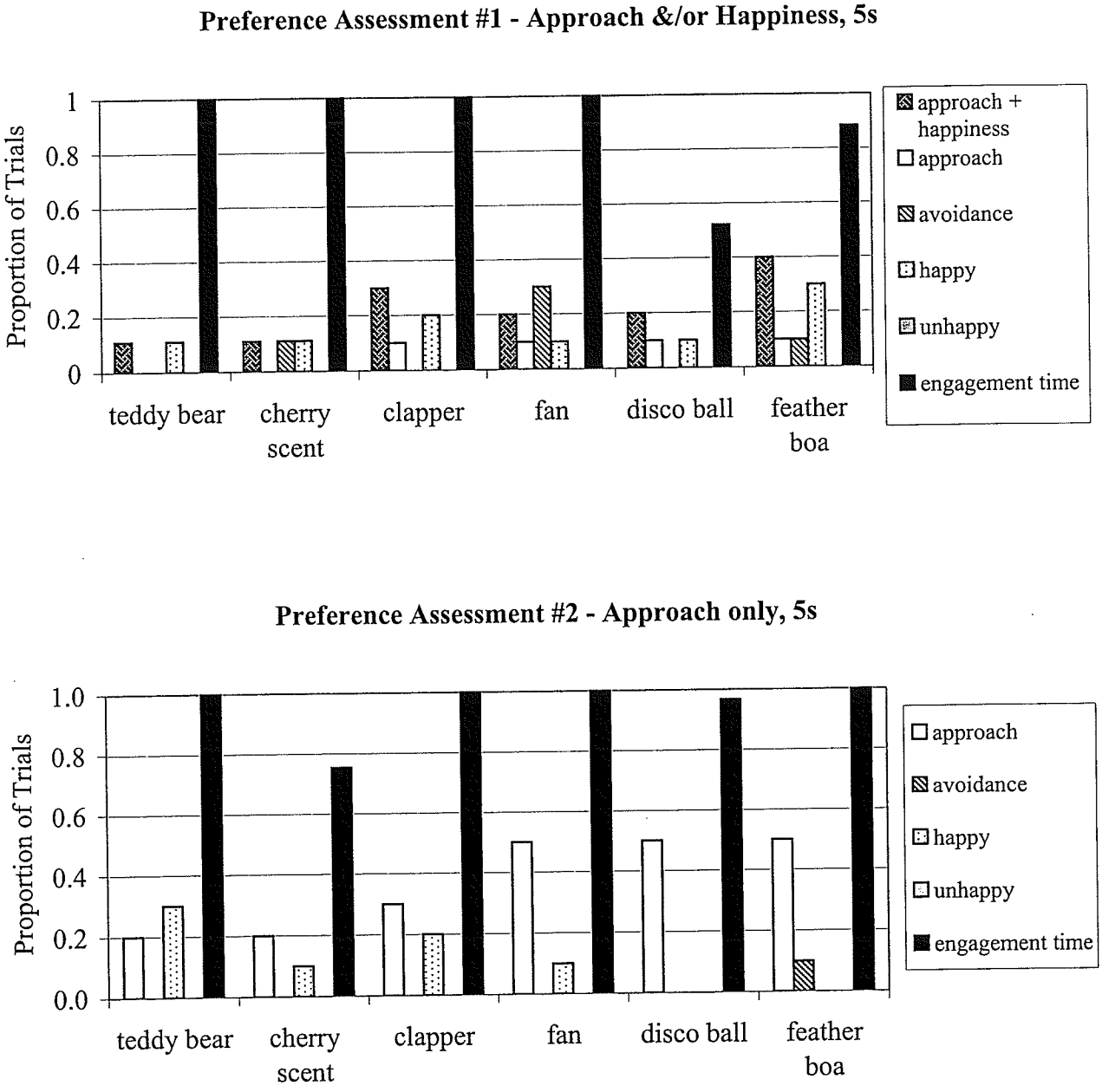

Figure G3. Preference Assessment Results for Chris.

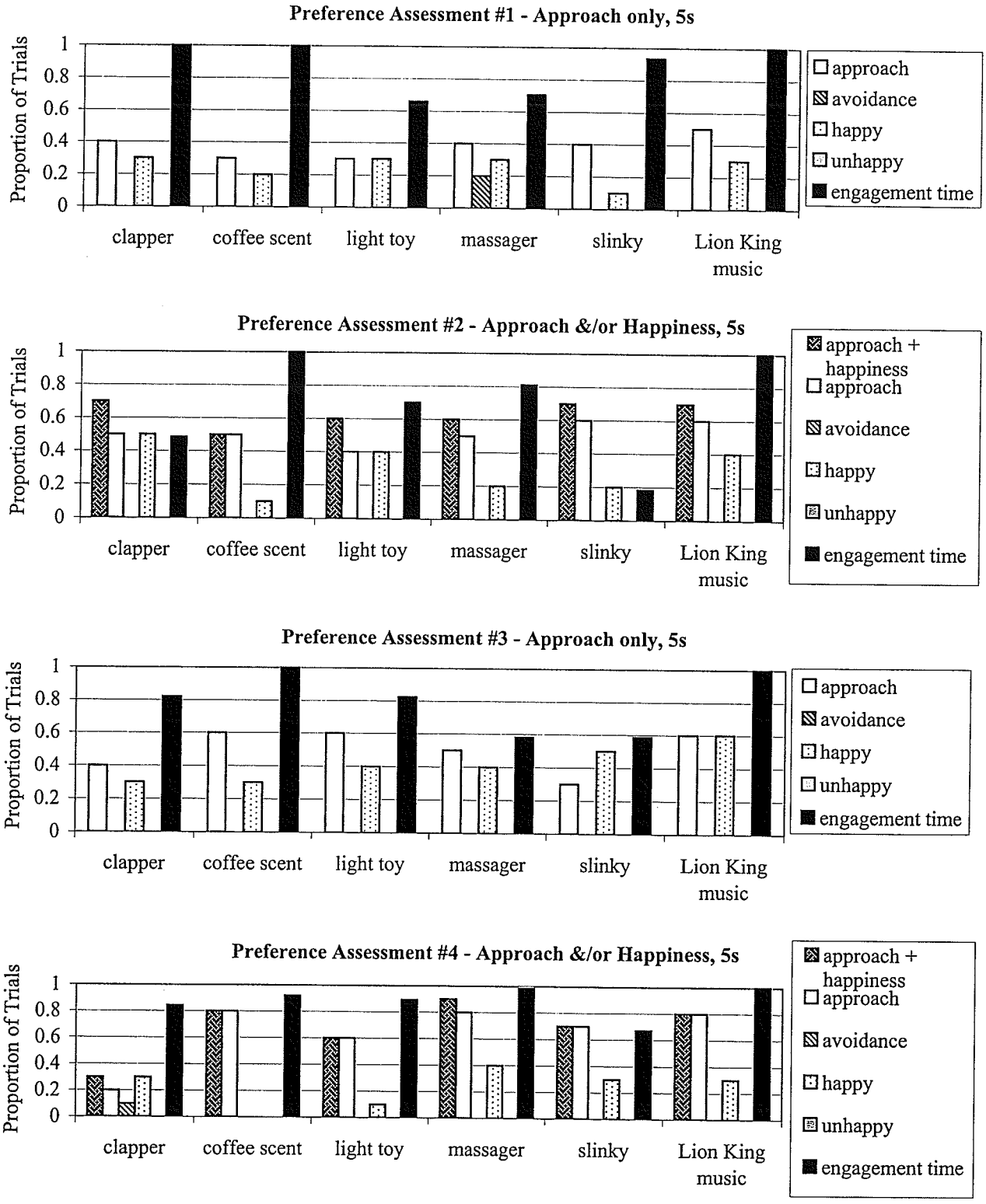

Figure G4. Preference Assessment Results for Edie (Experiment 1).

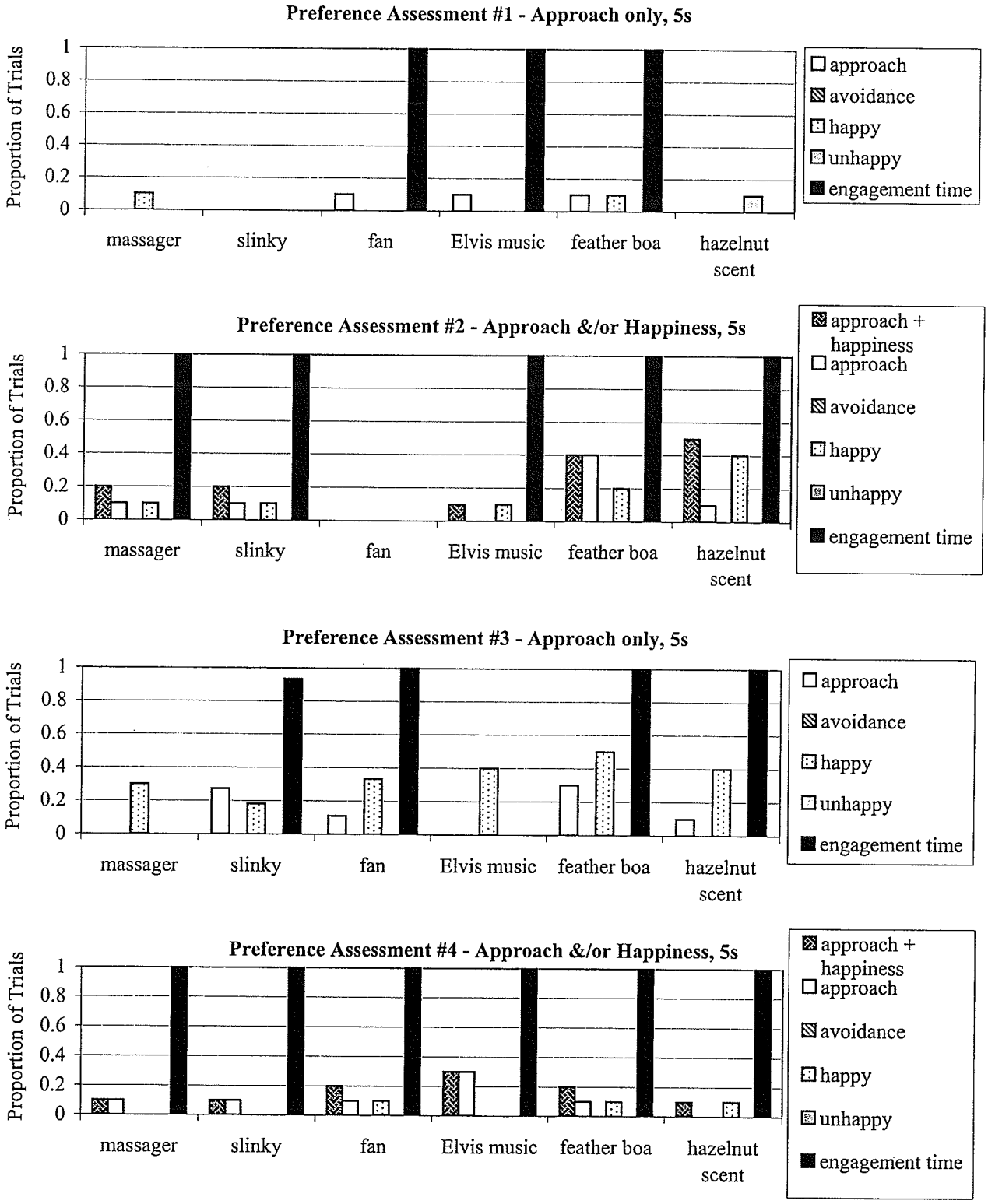

Figure G5. Preference Assessment Results for Fran (Experiment 1).

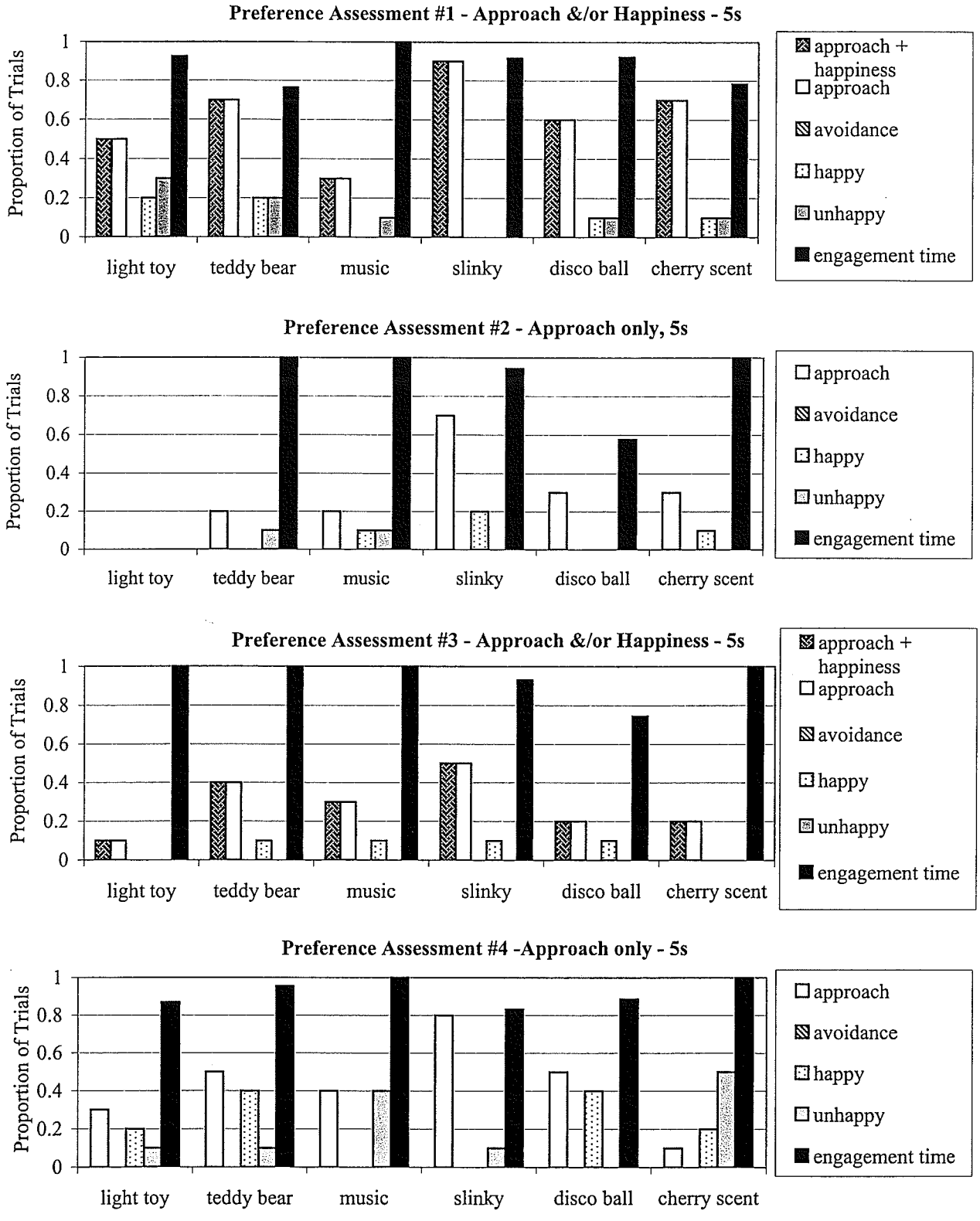

Figure G6. Preference Assessment Results for Gina (Experiment 1).

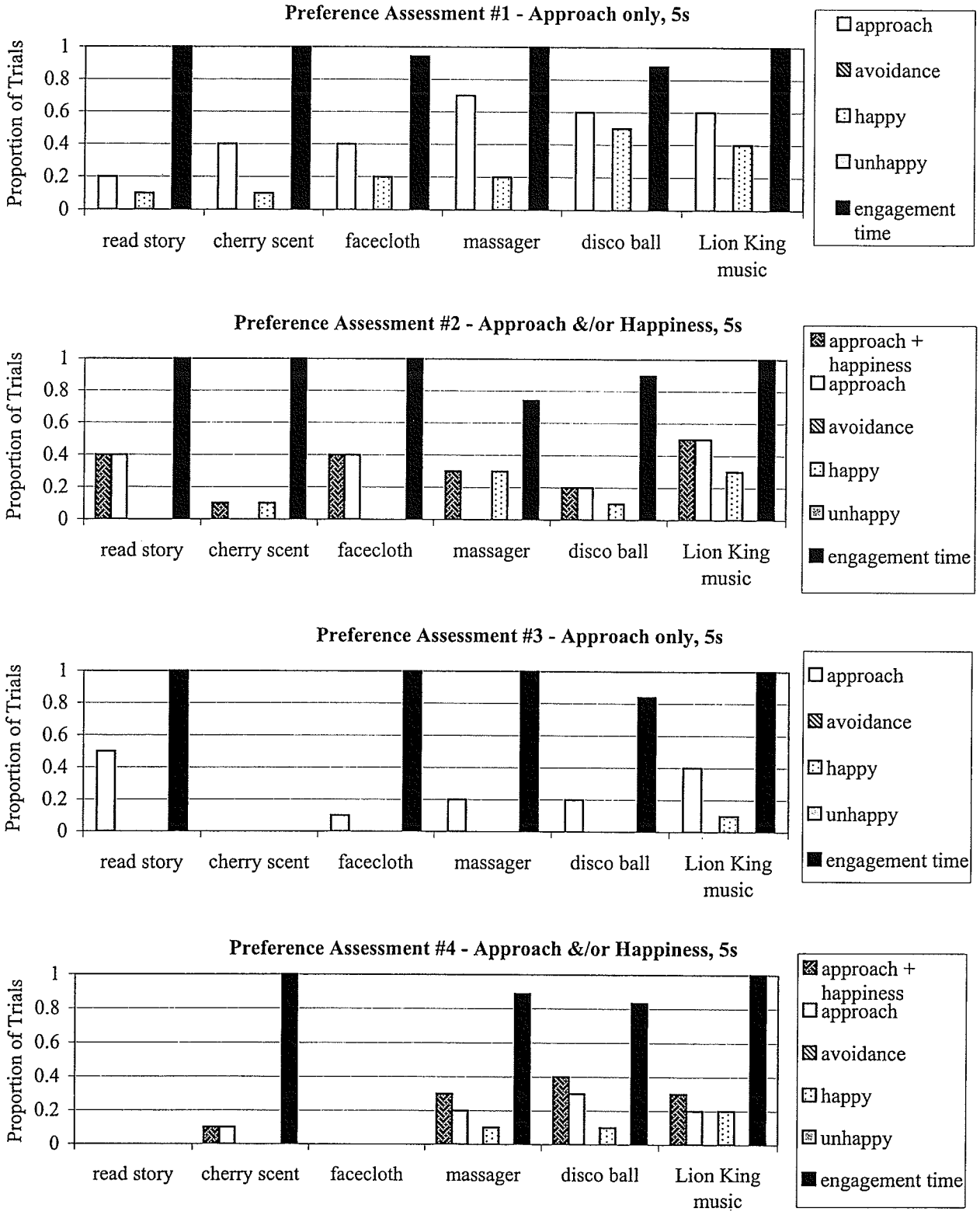

Figure G7. Preference Assessment Results for Heather.

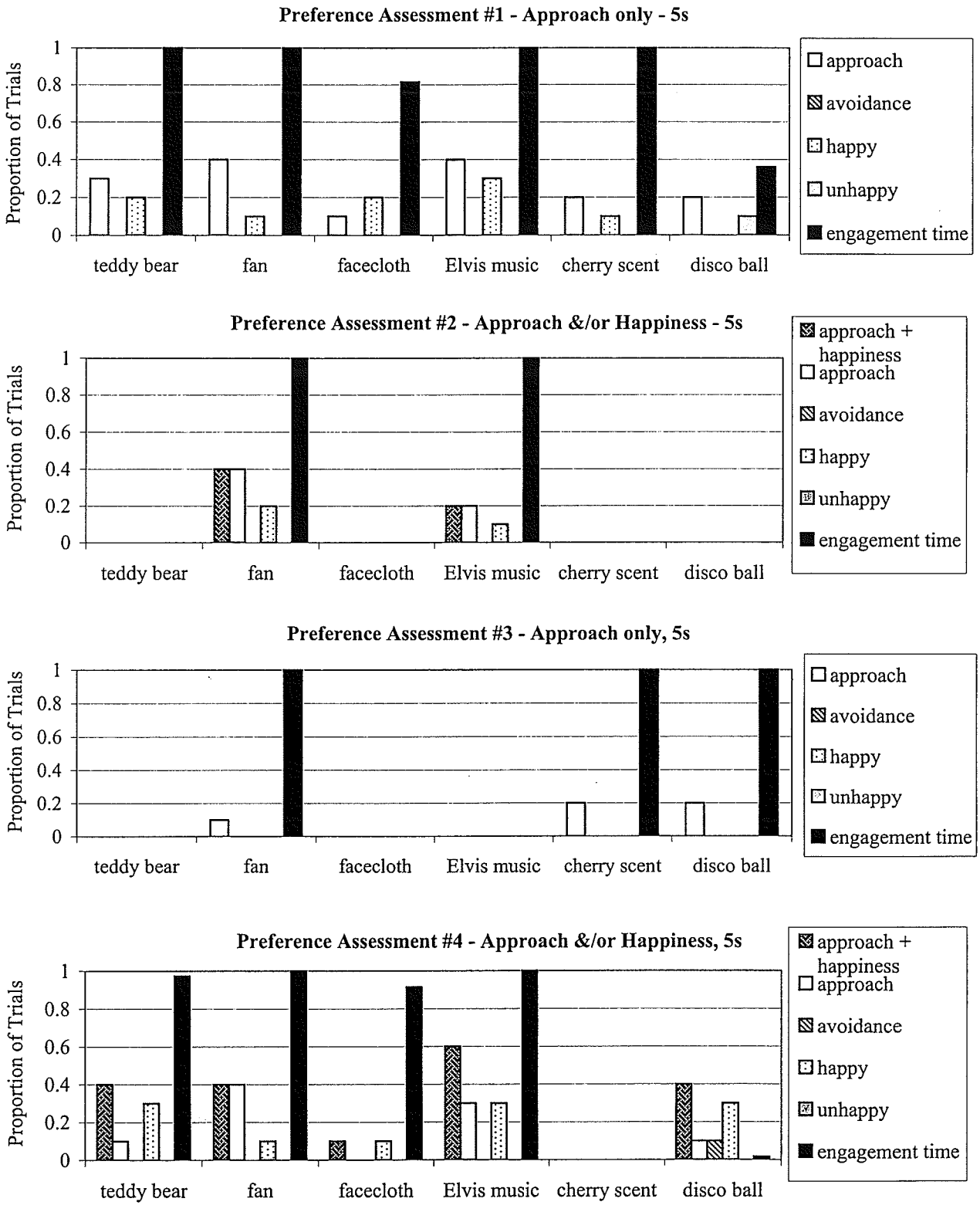

Figure G8. Preference Assessment Results for Ian.

Appendix H

Reinforcer Test Results for all Participants in Experiment 1

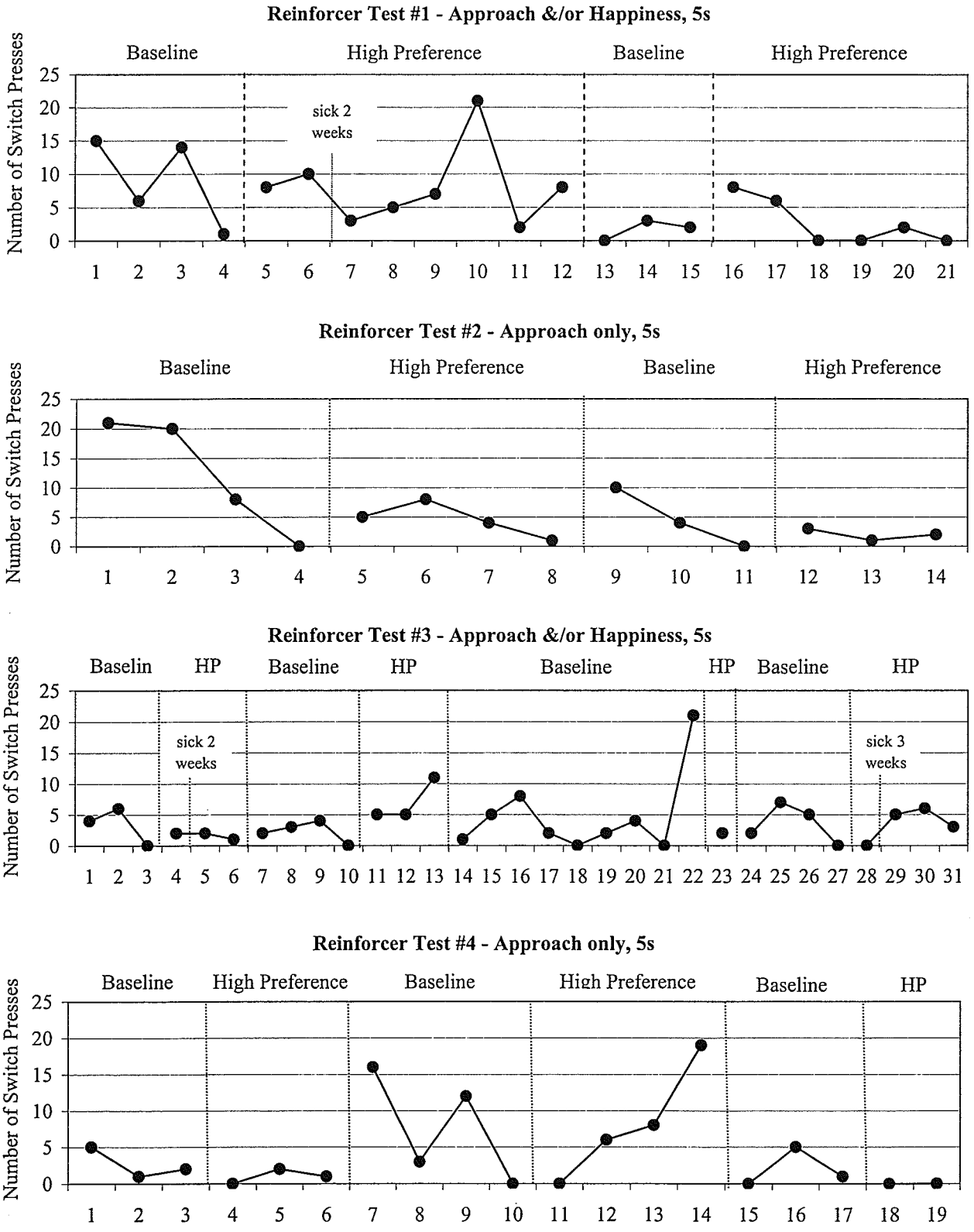

Figure H1. Reinforcer Test Results for Adam (Experiment 1).

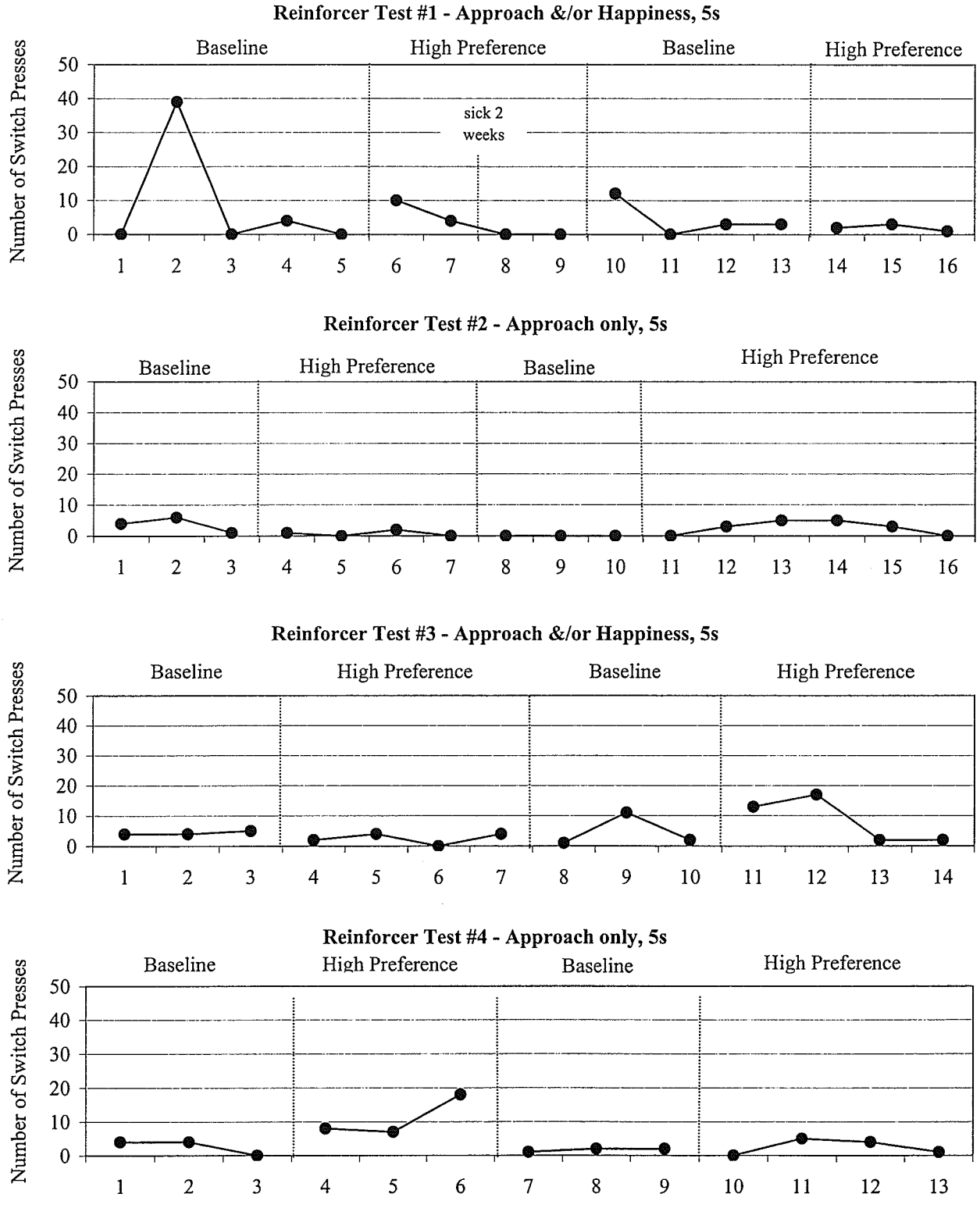

Figure H2. Reinforcer Test Results for Burt (Experiment 1).

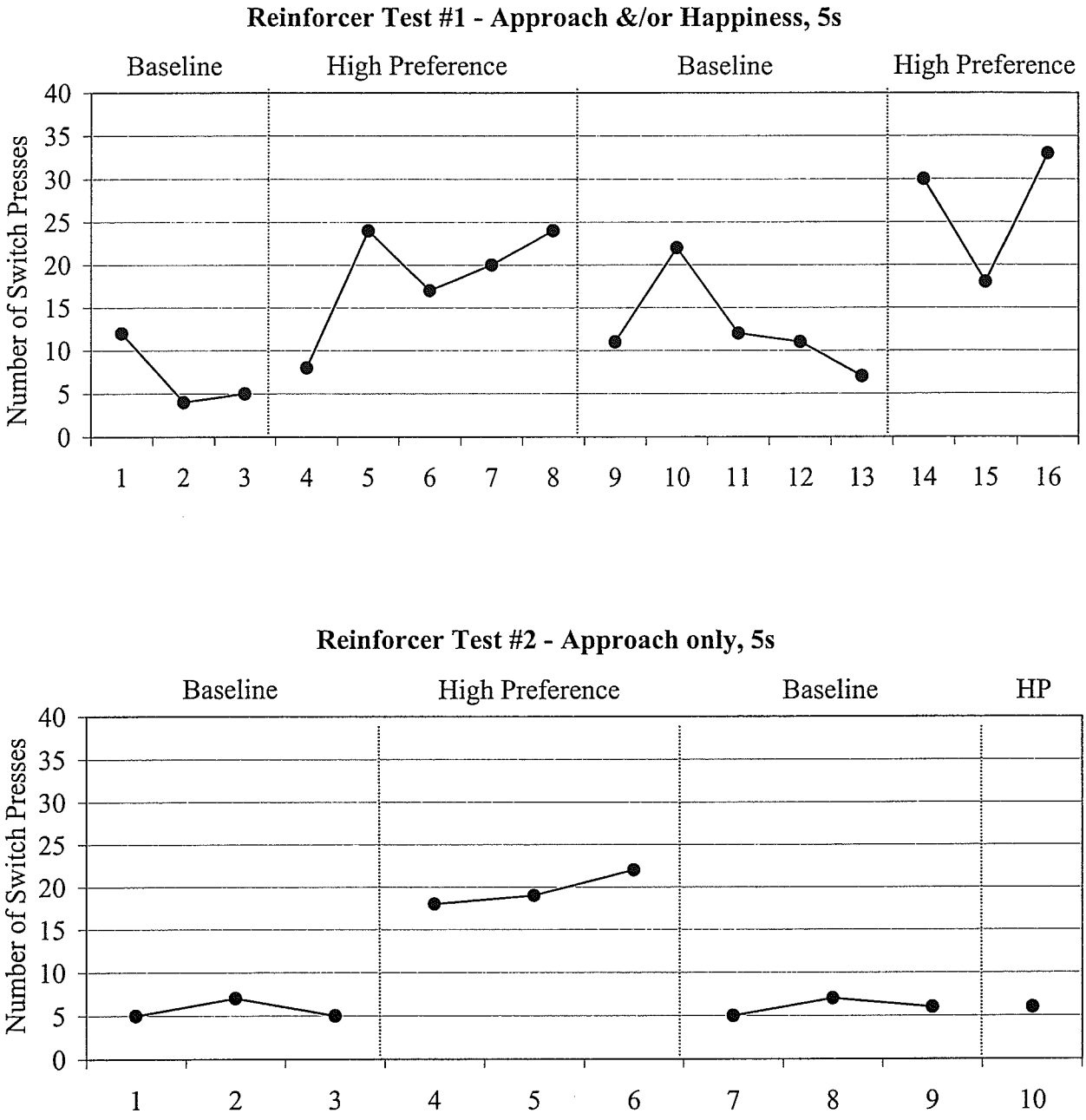

Figure H3. Reinforcer Test Results for Chris.

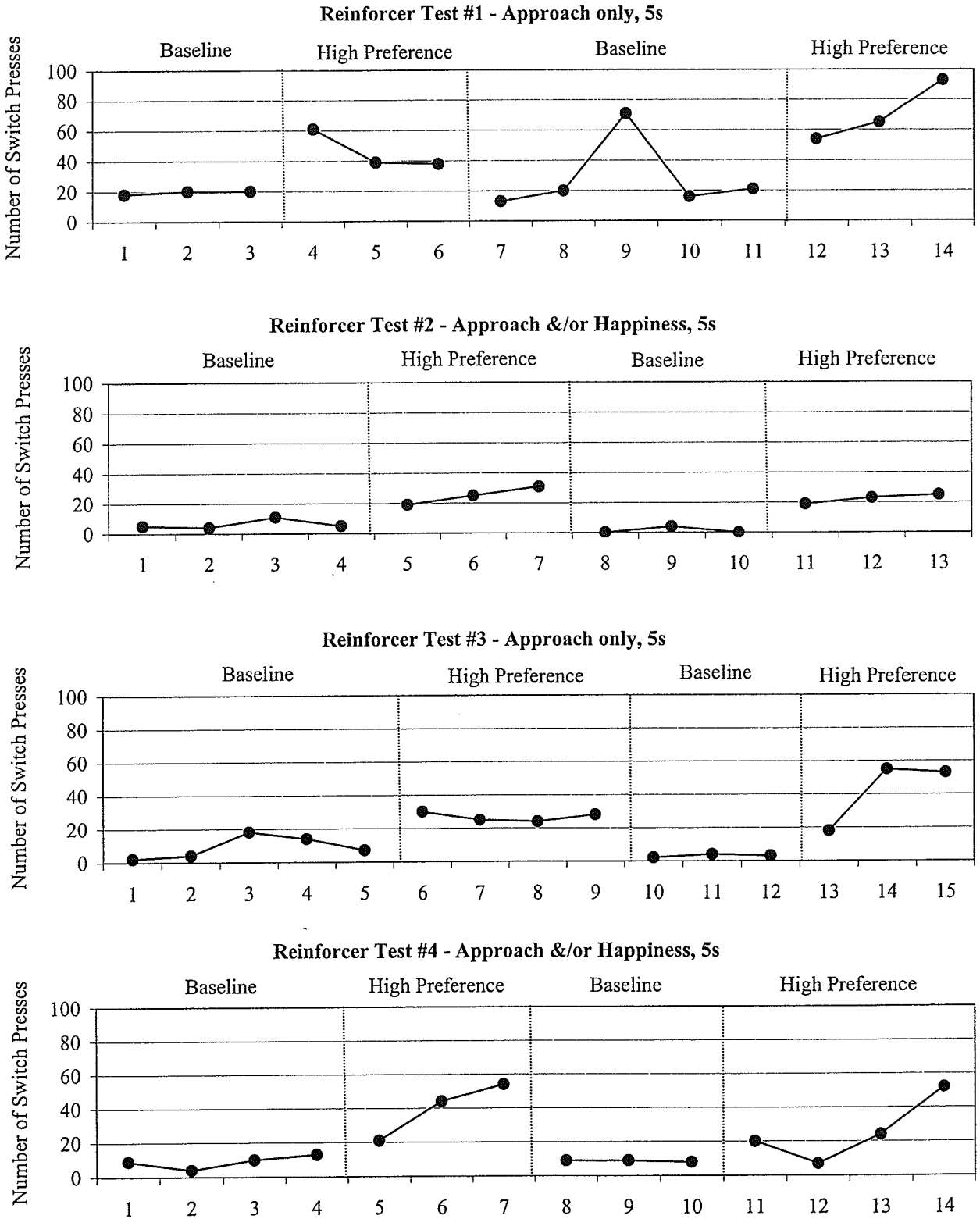

Figure H4. Reinforcer Test Results for Edie (Experiment 1).

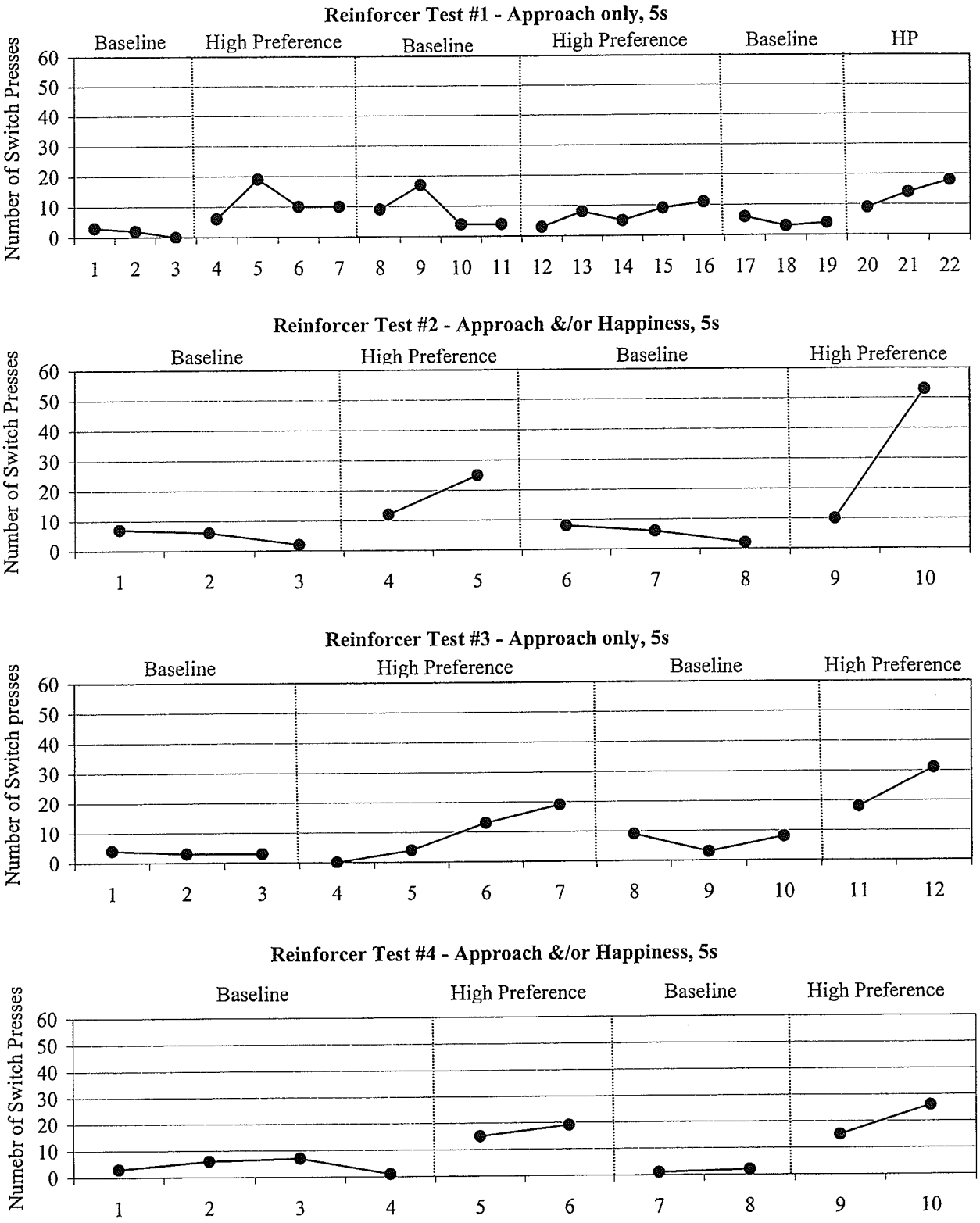

Figure H5. Reinforcer Test Results for Fran (Experiment 1).

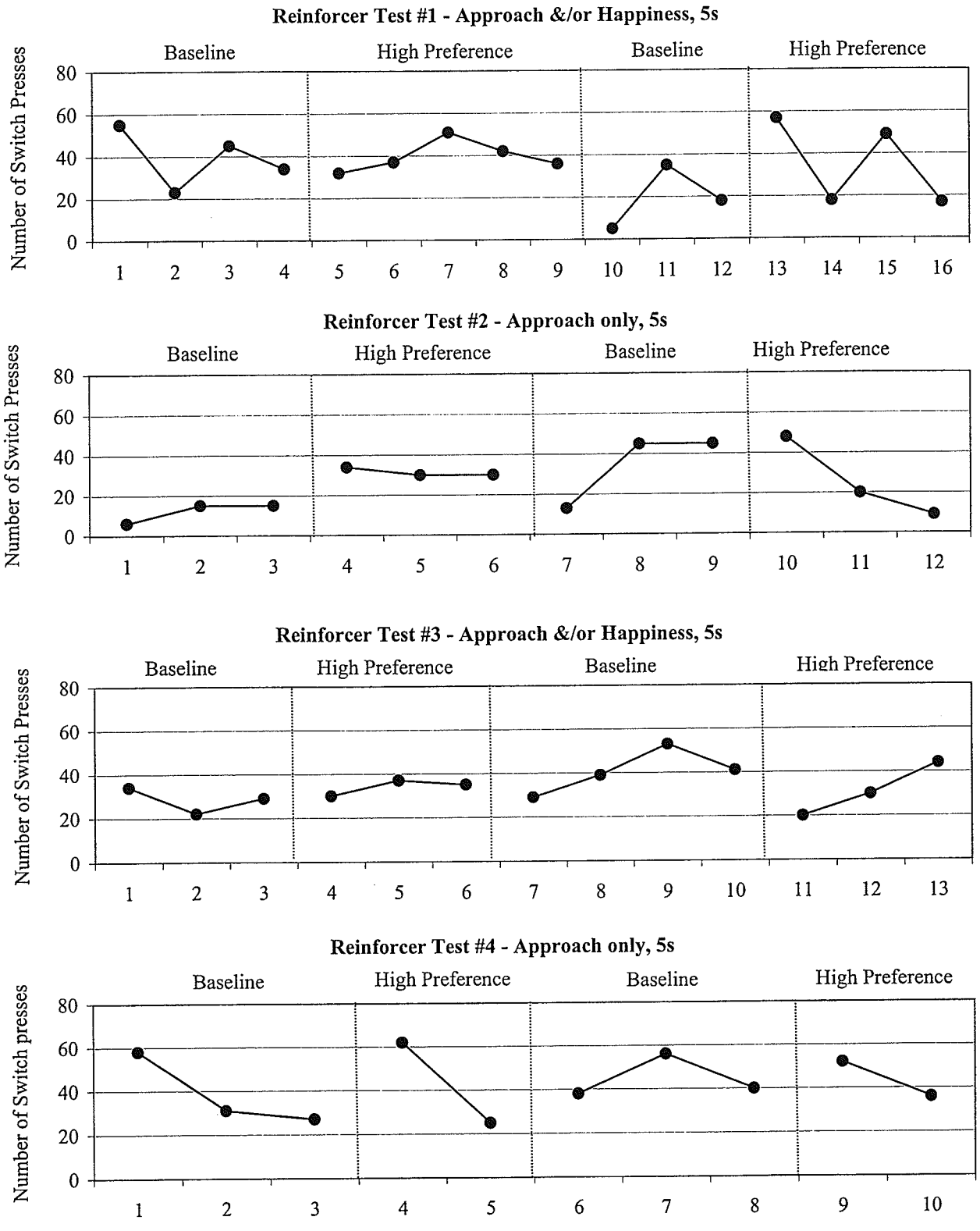

Figure H6. Reinforcer Test Results for Gina (Experiment 1).

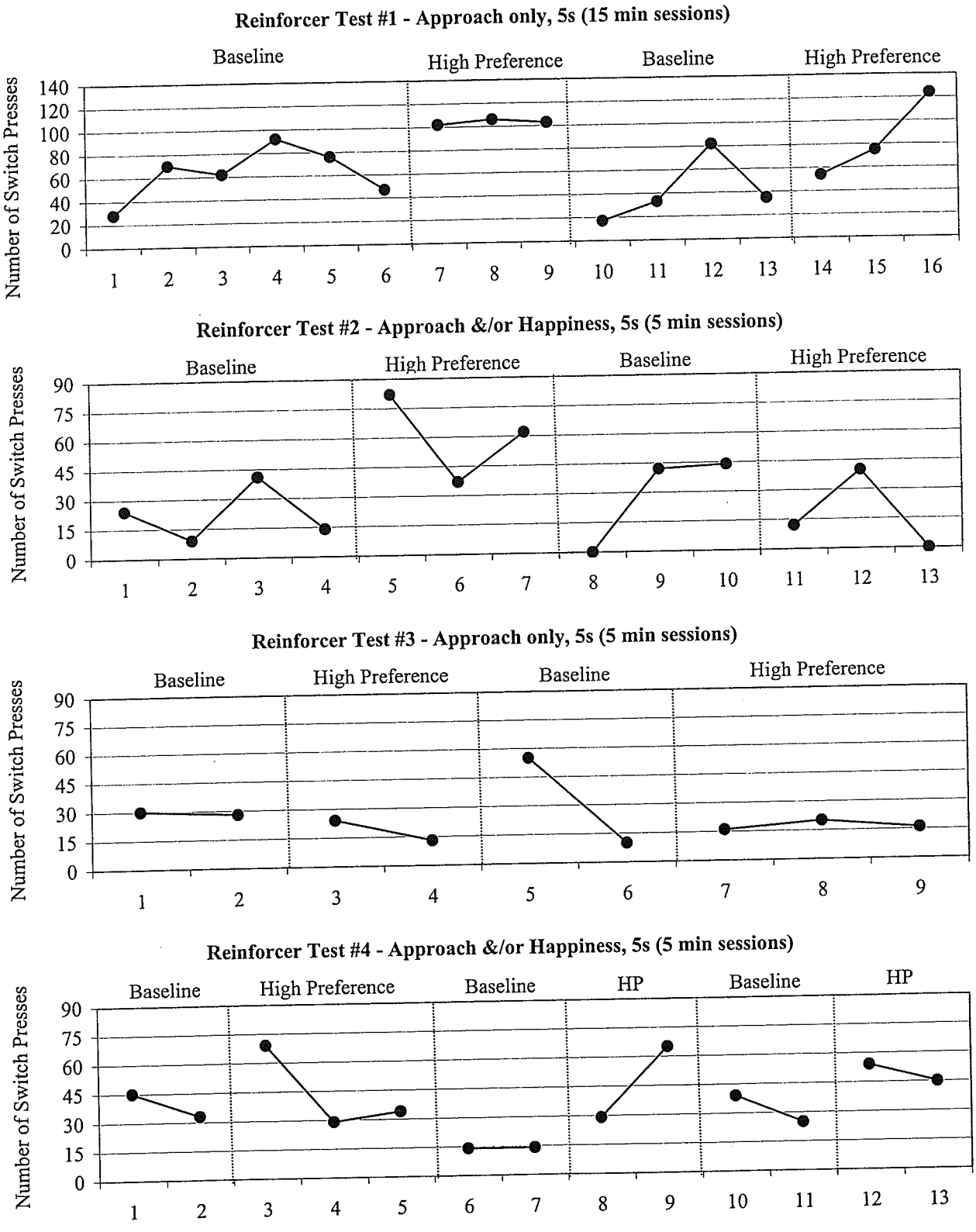

Figure H7. Reinforcer Test Results for Heather.

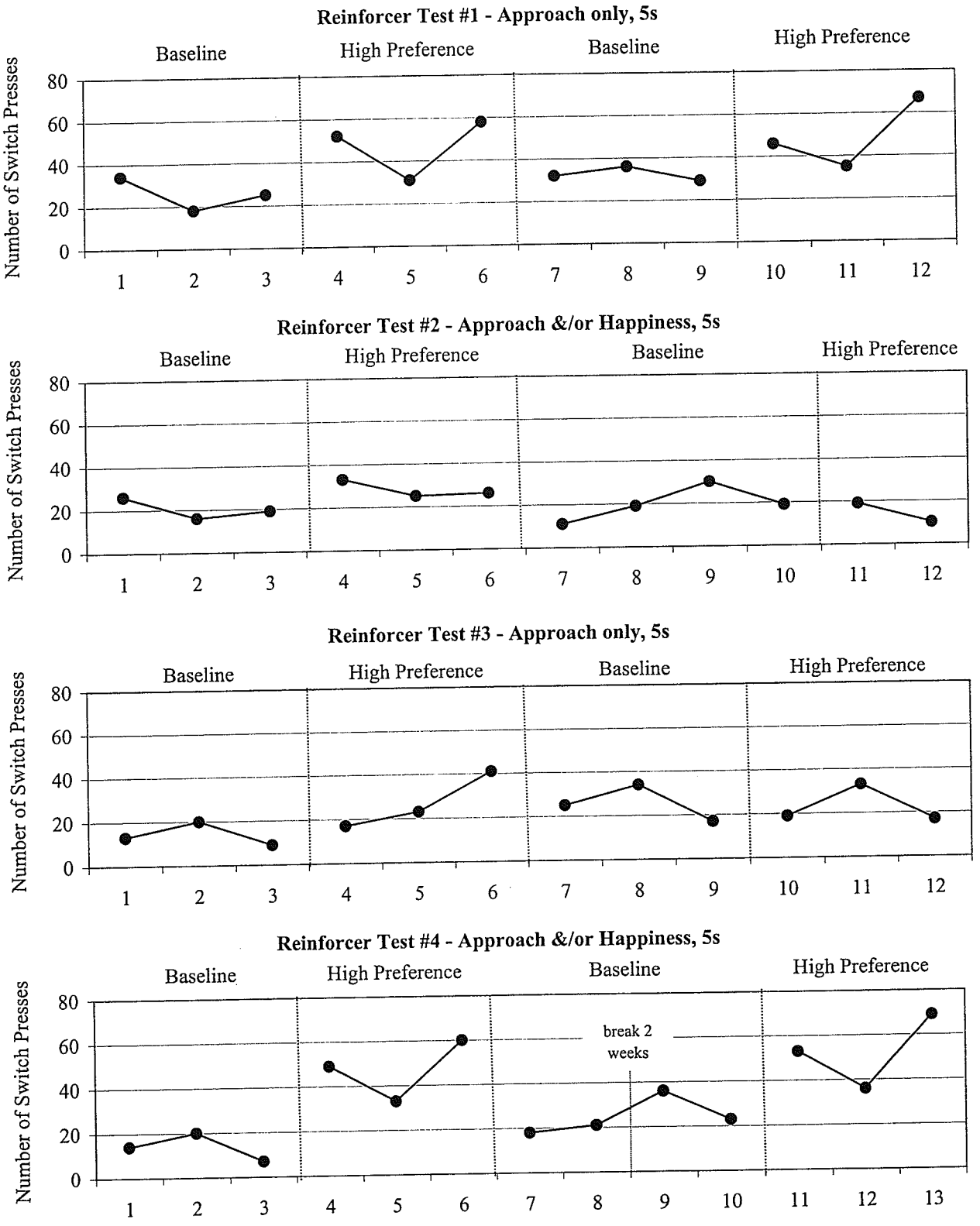

Figure H8. Reinforcer Test Results for Ian.

Appendix I

Preference Assessment Results for all Participants in Experiment 2

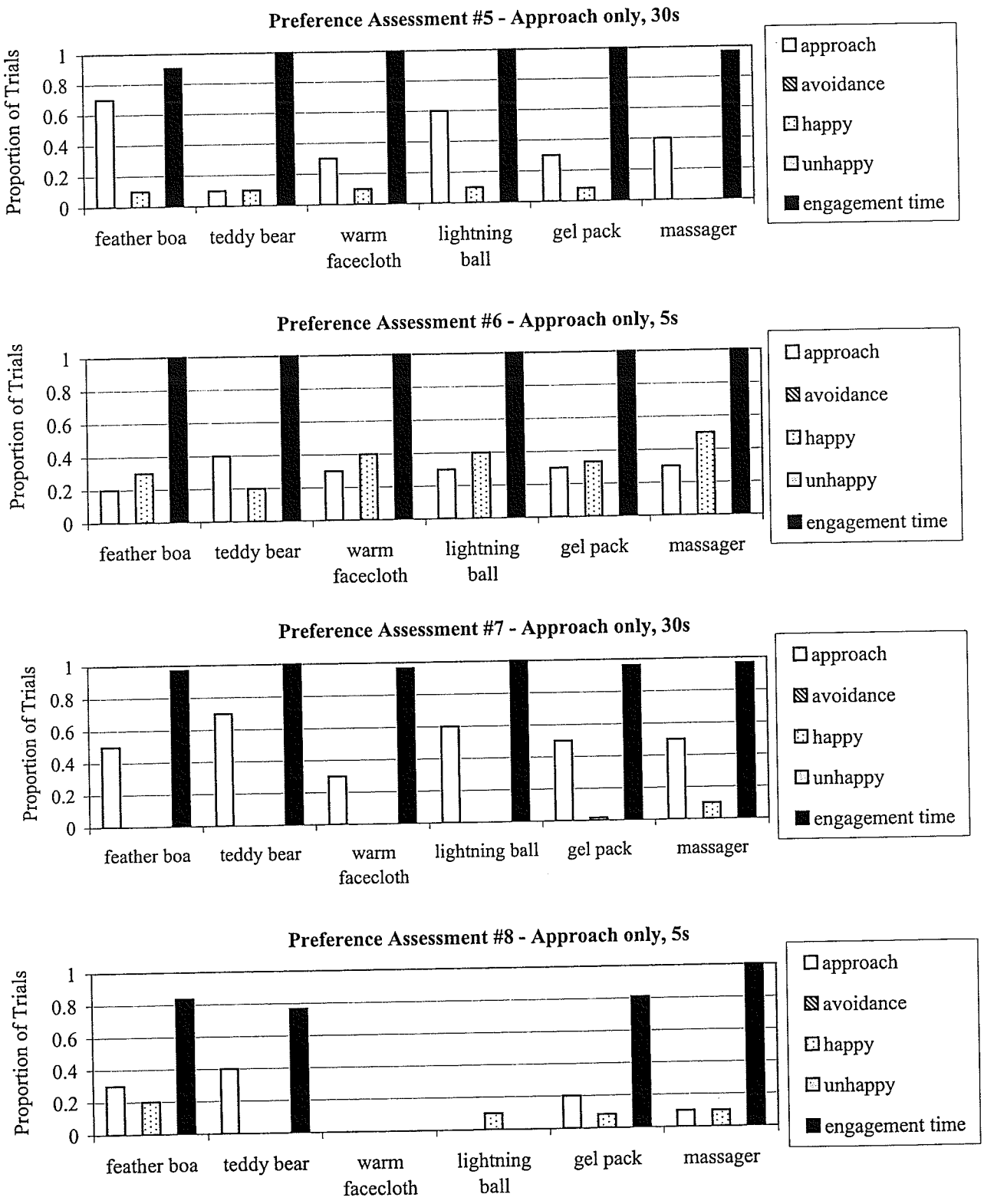

Figure 11. Preference Assessment Results for Adam (Experiment 2).

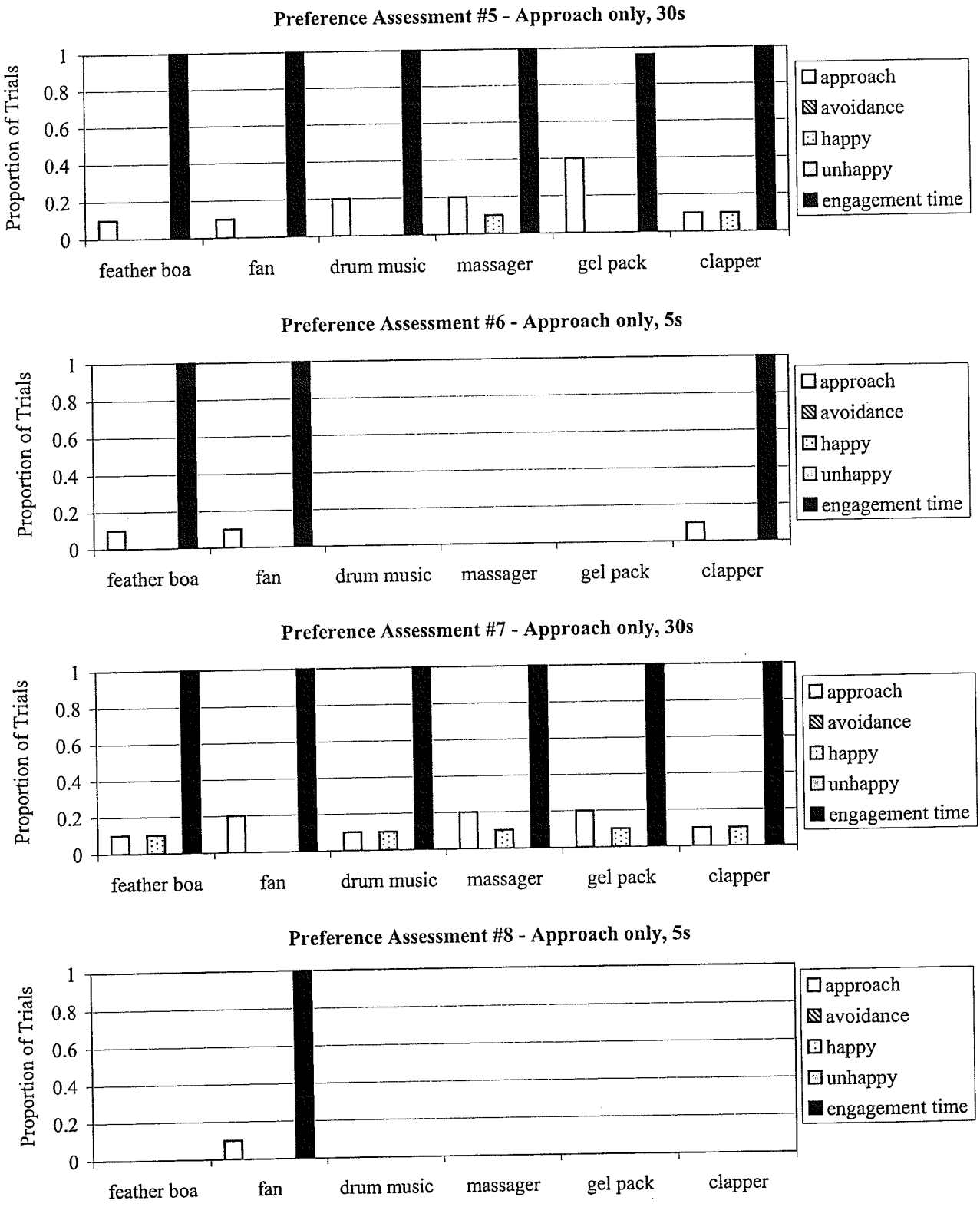

Figure I2. Preference Assessment Results for Burt (Experiment 2).

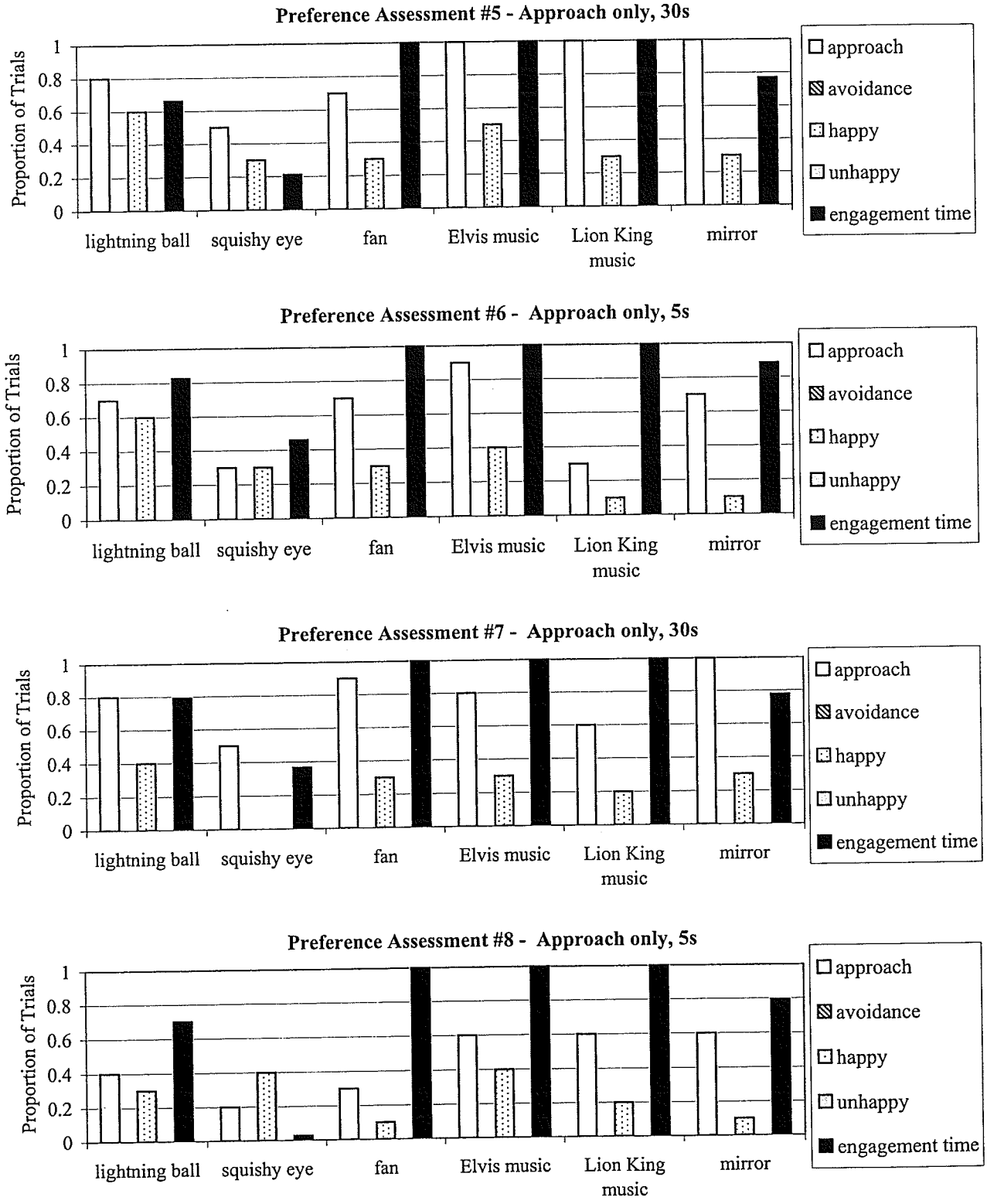

Figure I3. Preference Assessment Results for Edie (Experiment 2)

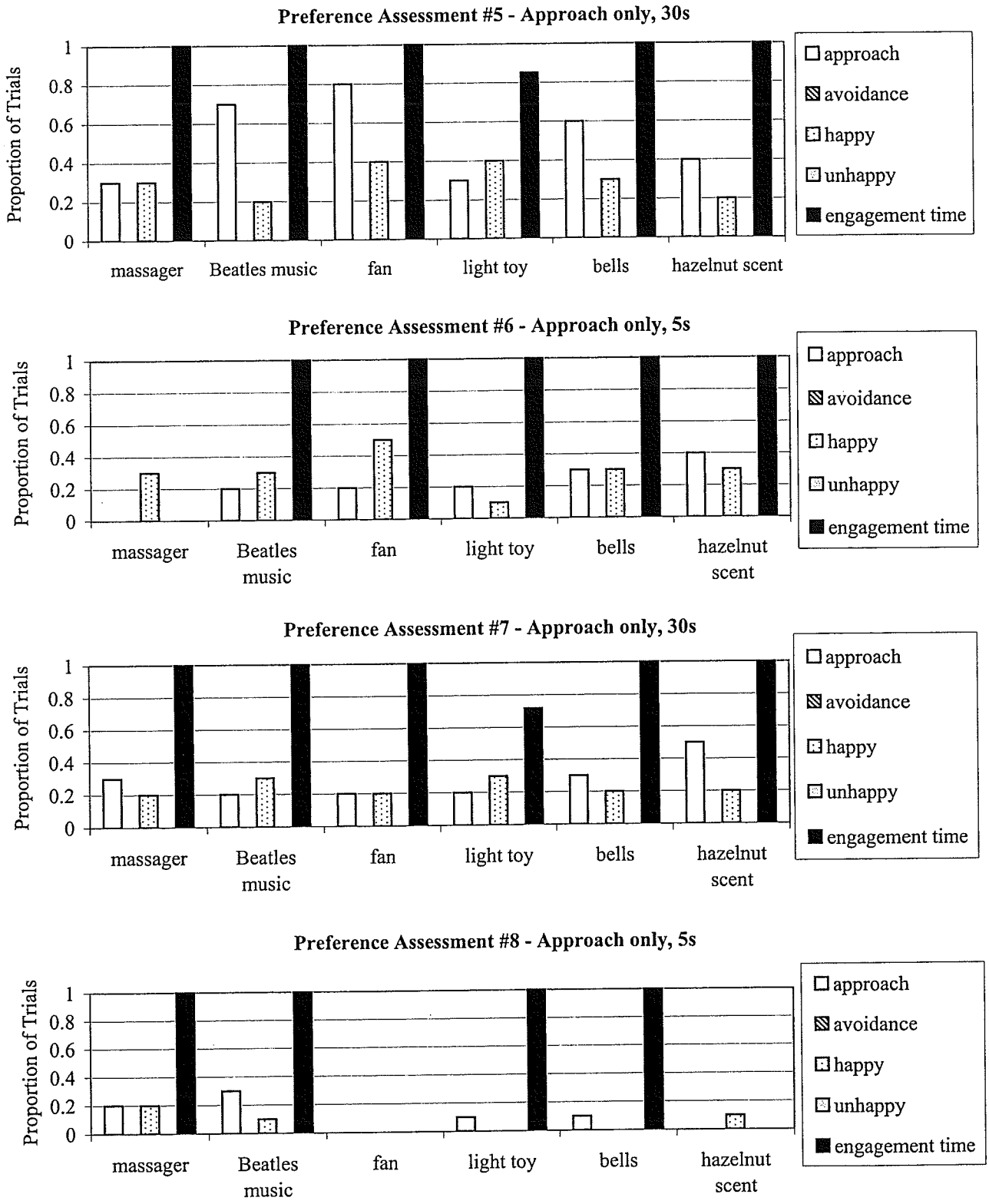

Figure I4. Preference Assessment Results for Fran (Experiment 2).

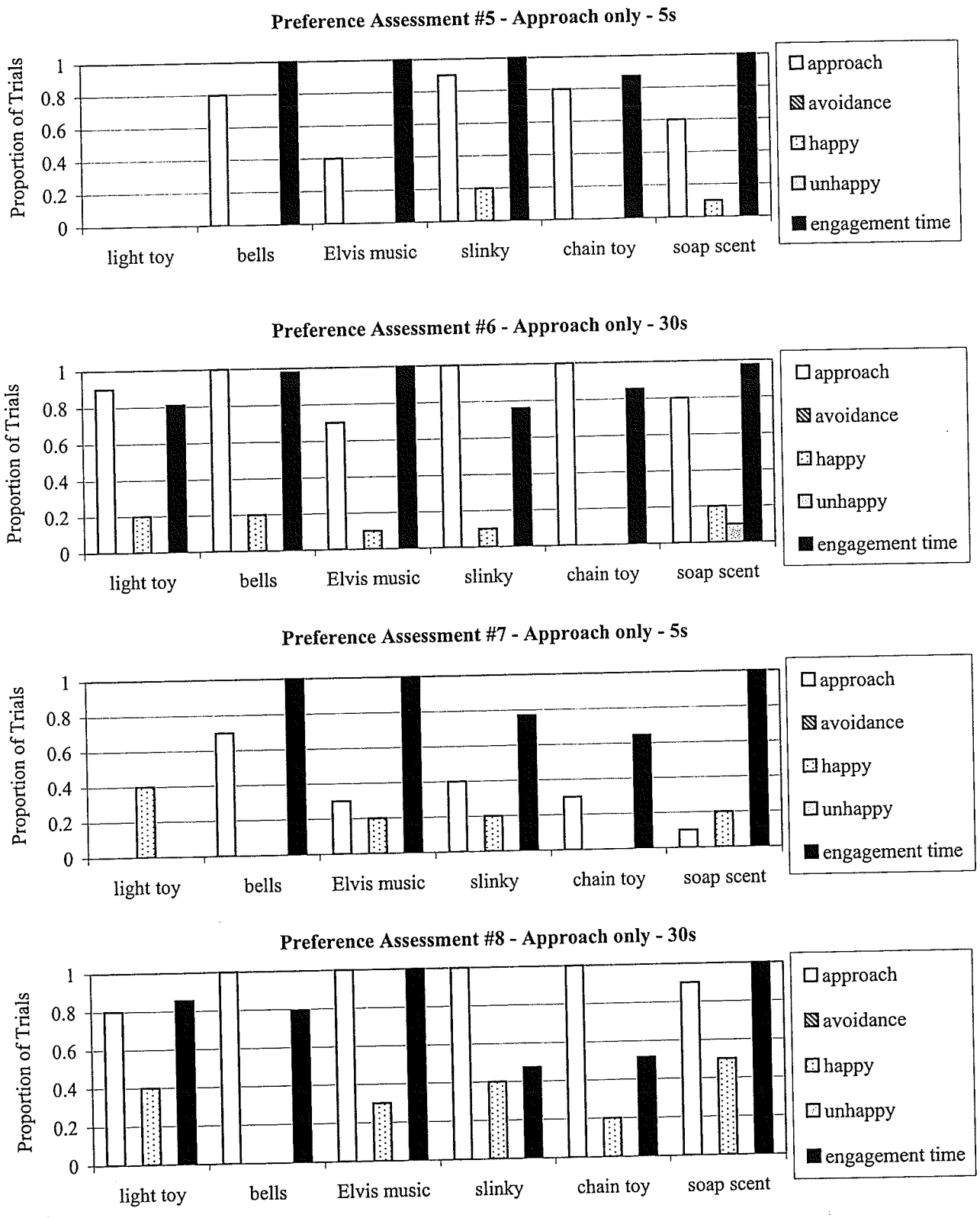

Figure I5. Preference Assessment Results for Gina (Experiment 2).

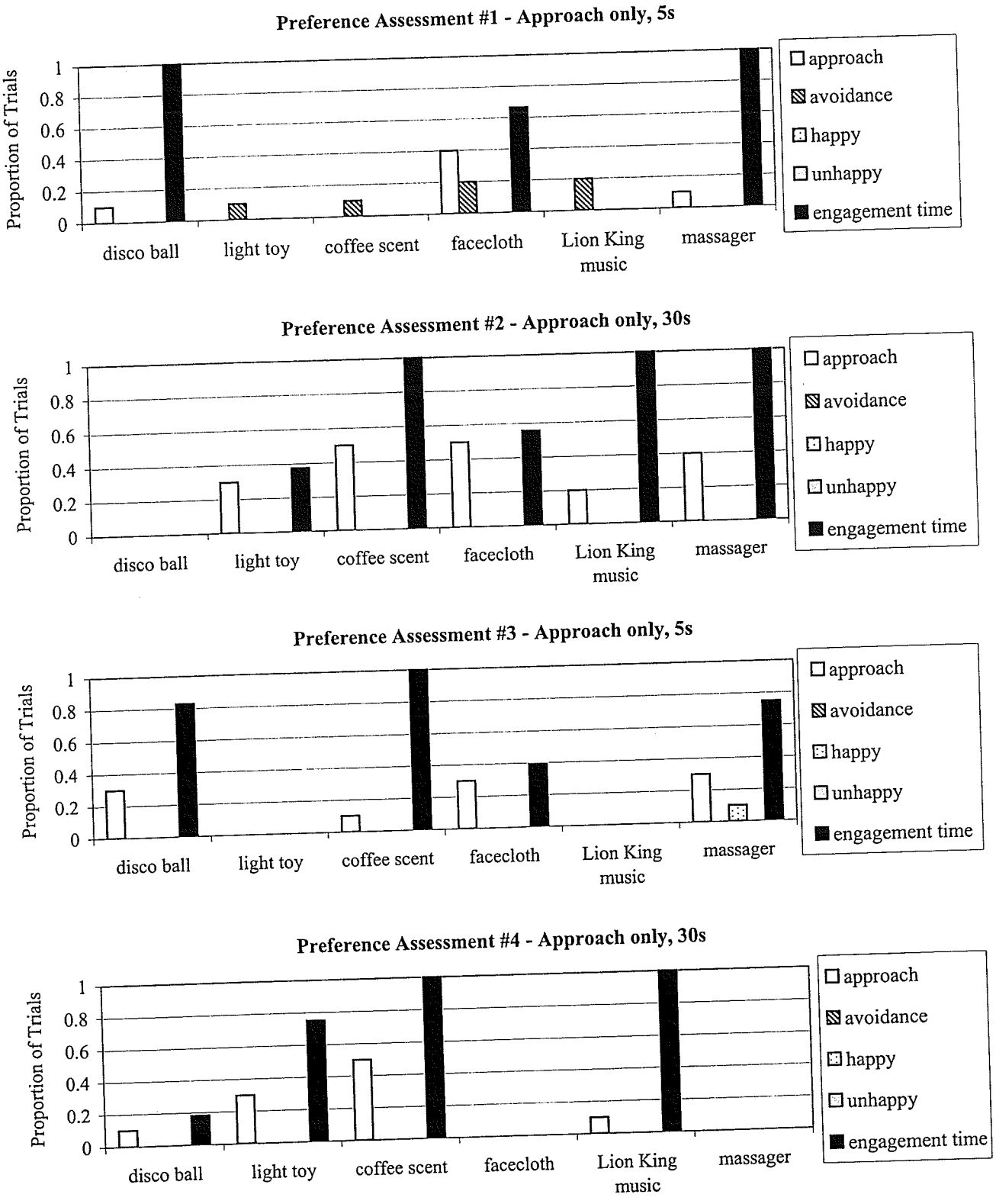

Figure I6. Preference Assessment Results for James.

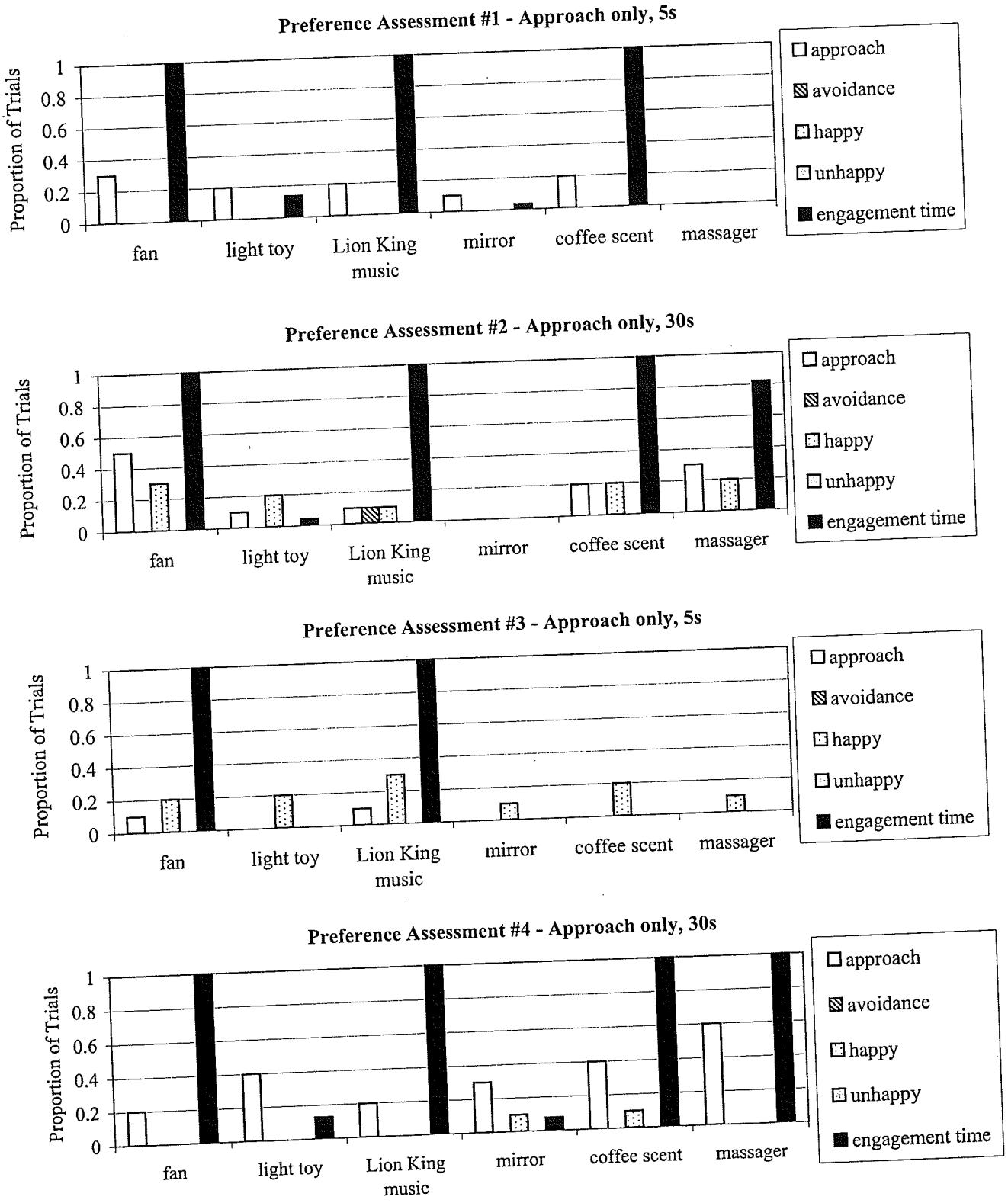

Figure I7. Preference Assessment Results for Kelly.

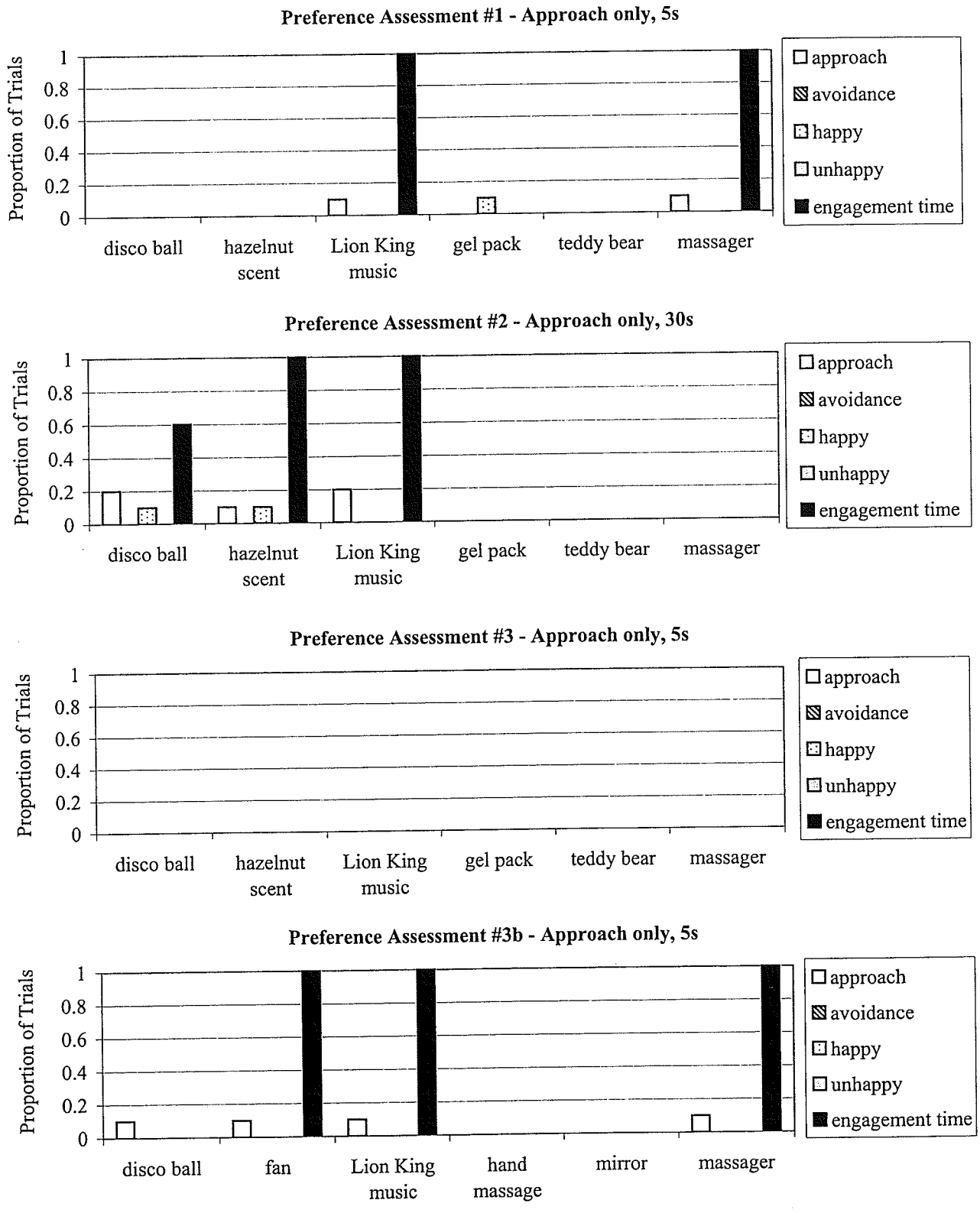

Figure I8. Preference Assessment Results for Lester.

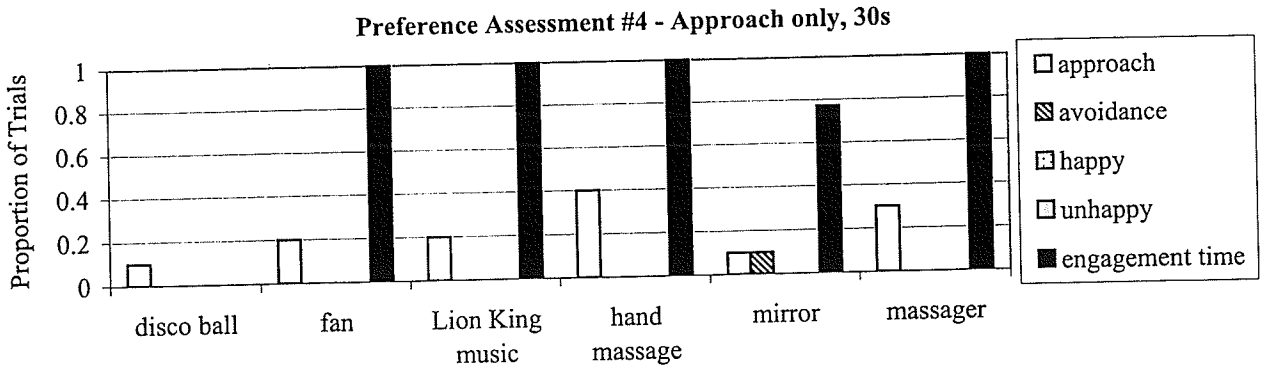

Figure I8 (continued). Preference Assessment Results for Lester.

Appendix J

Reinforcer Test Results for all Participants in Experiment 2

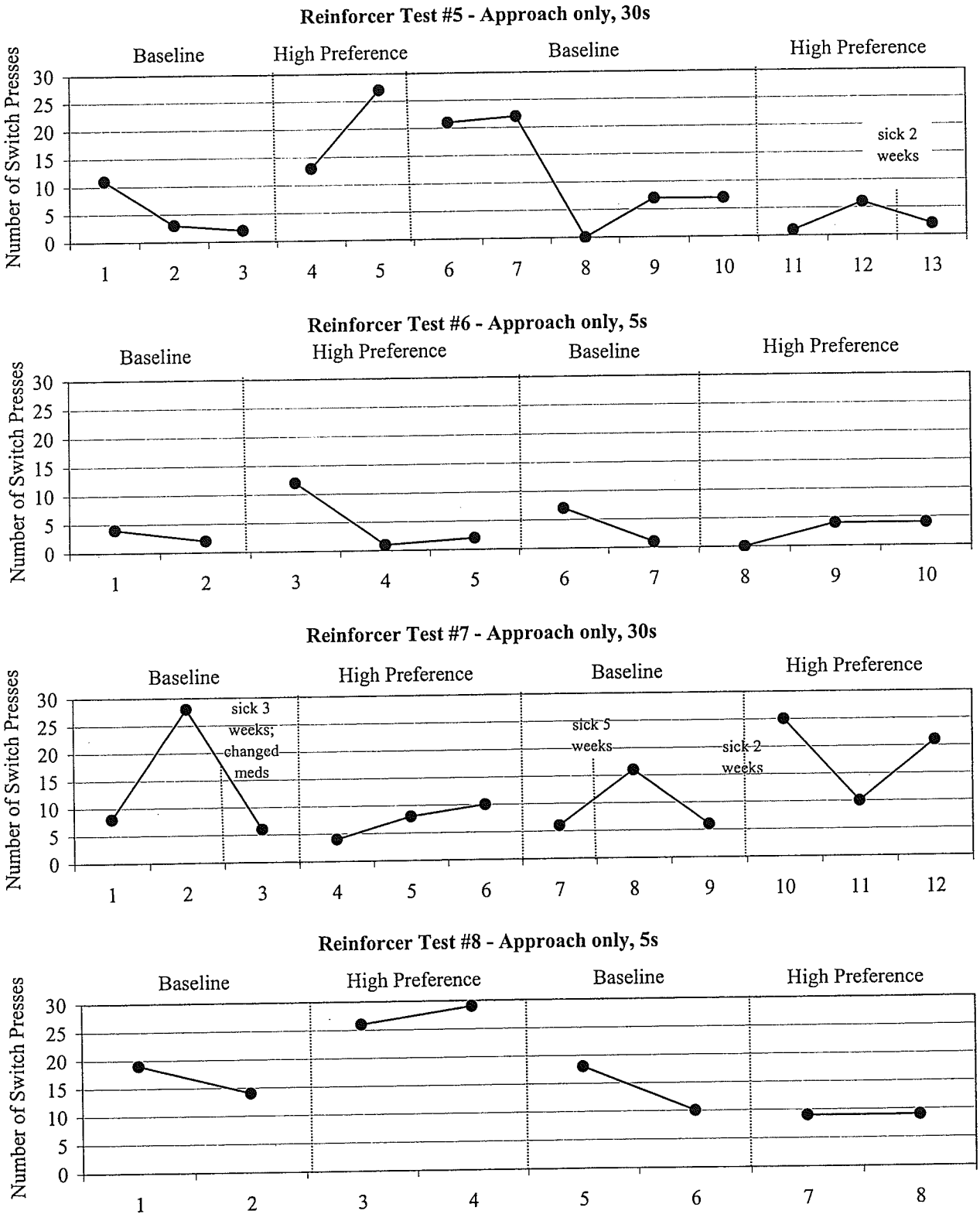

Figure J1. Reinforcer Test Results for Adam (Experiment 2).

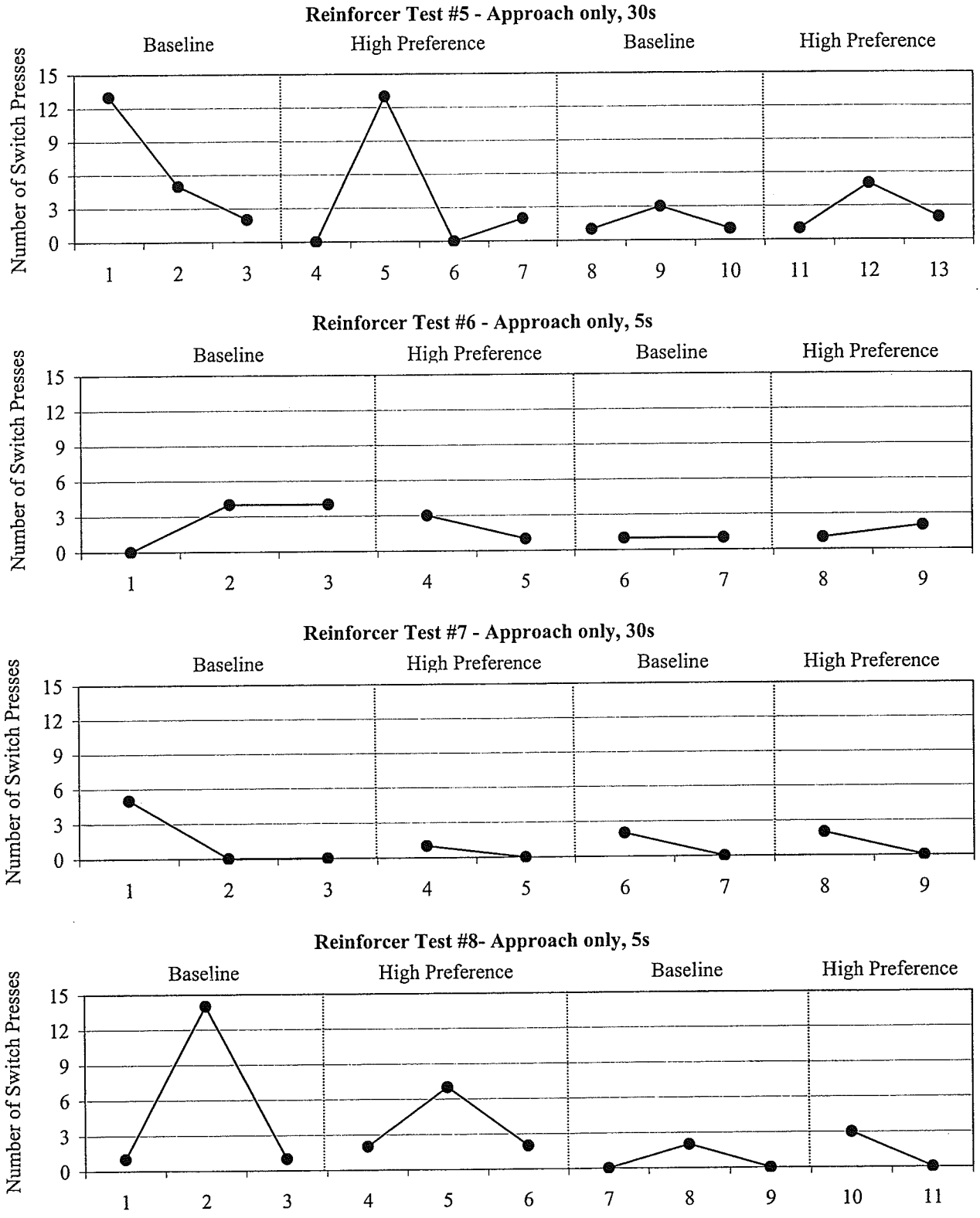

Figure J2. Reinforcer Test Results for Burt (Experiment 2).

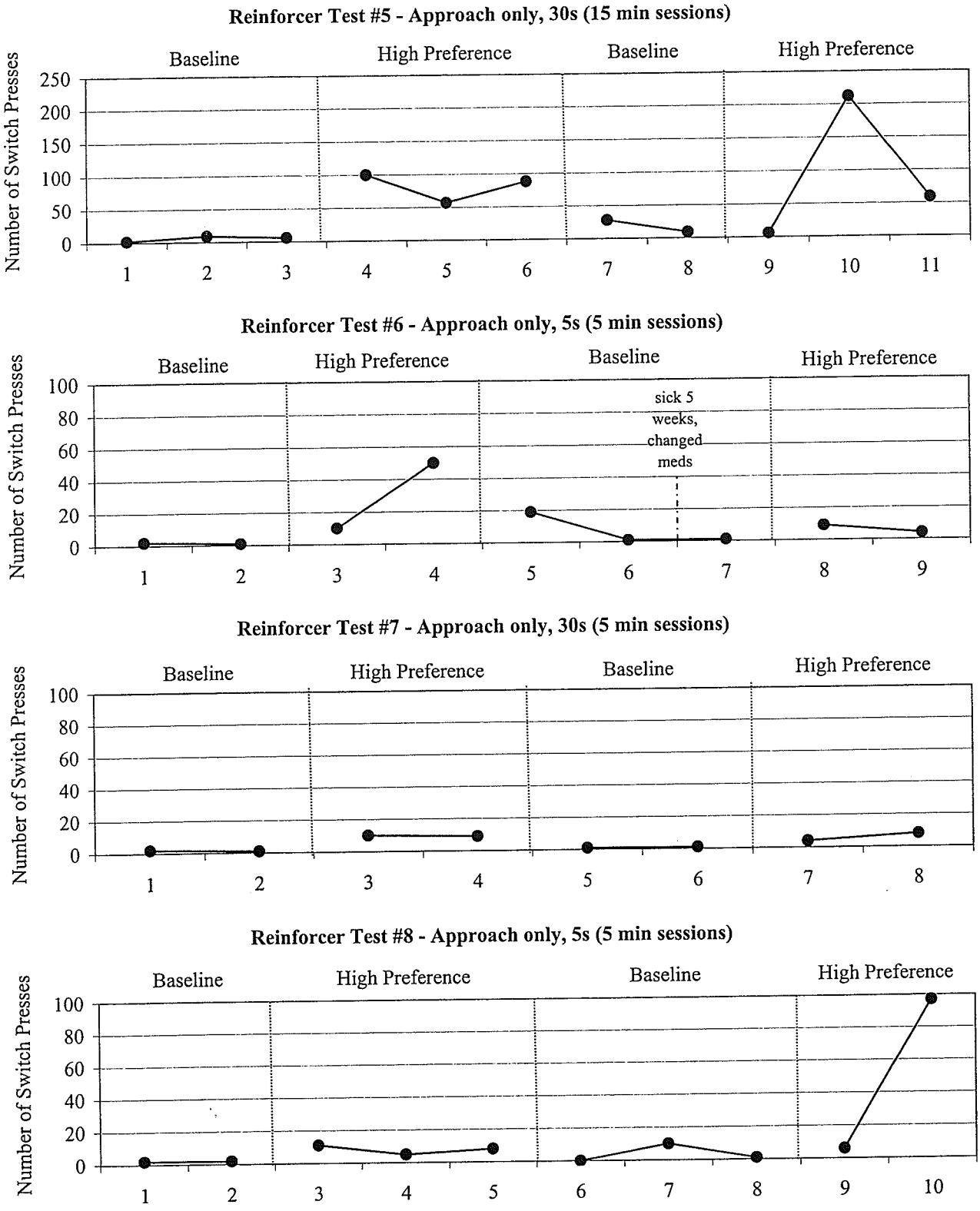

Figure J3. Reinforcer Test Results for Edie (Experiment 2).

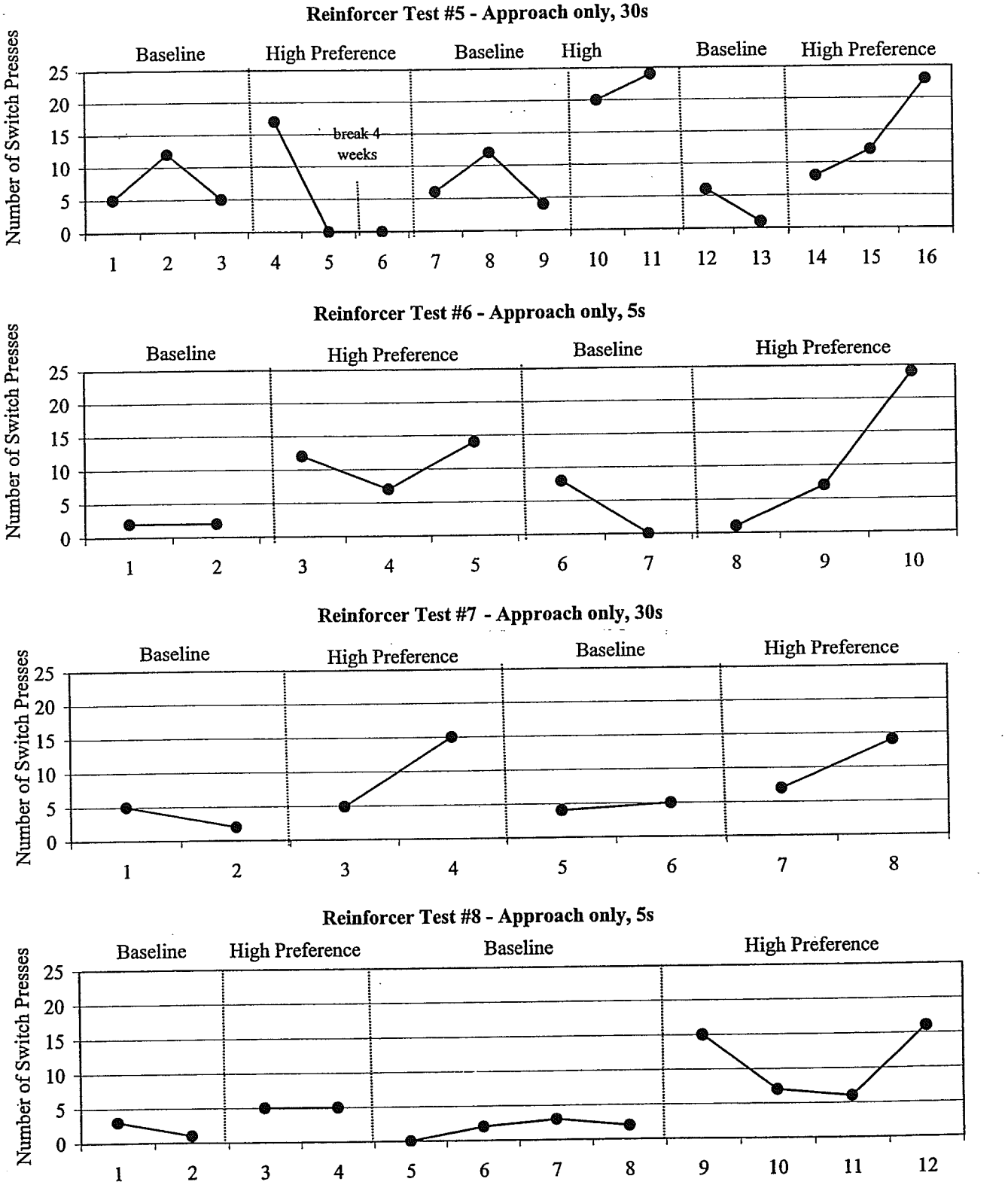

Figure J4. Reinforcer Test Results for Fran (Experiment 2).

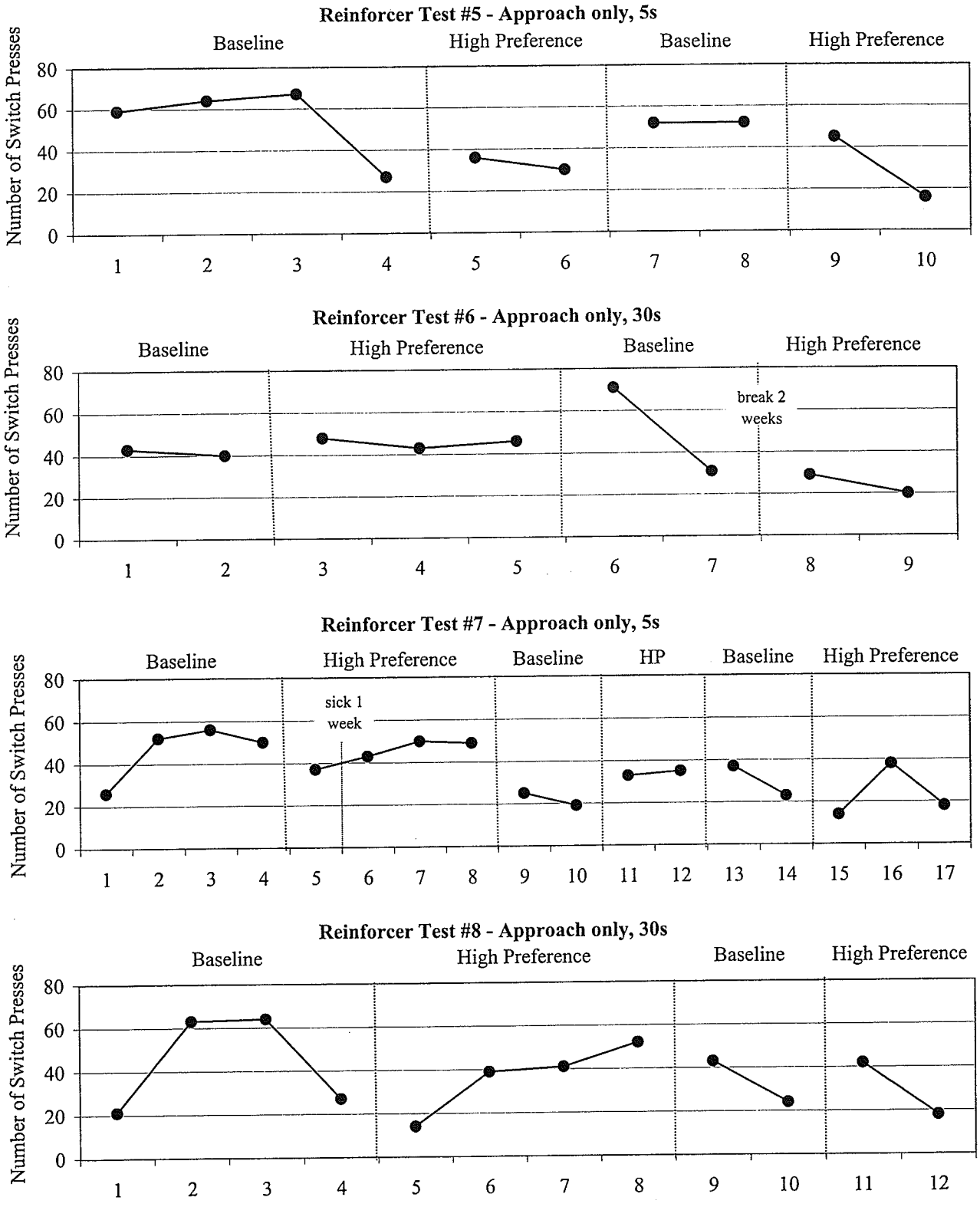

Figure J5. Reinforcer Test Results for Gina (Experiment 2).

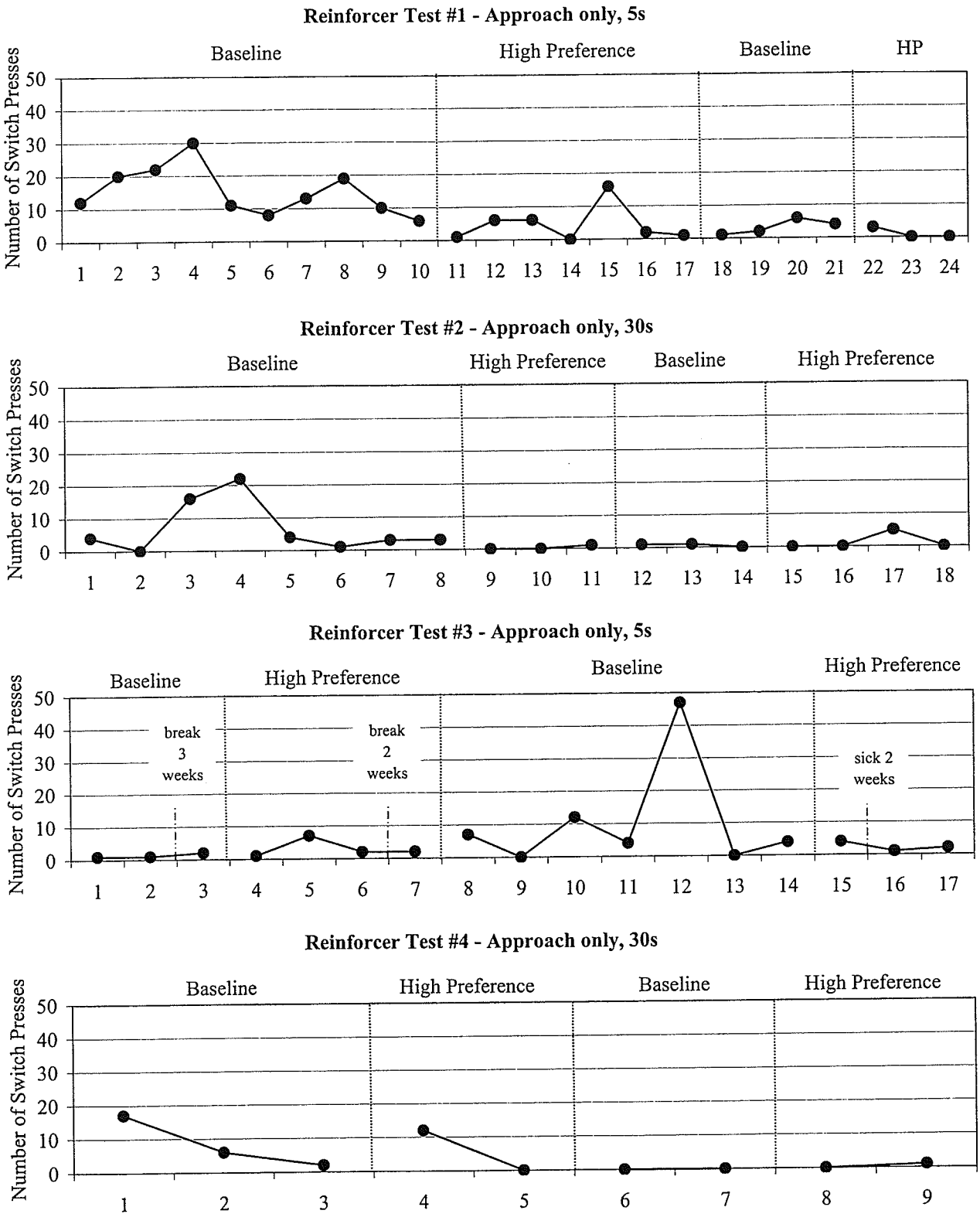

Figure J6. Reinforcer Test Results for James.

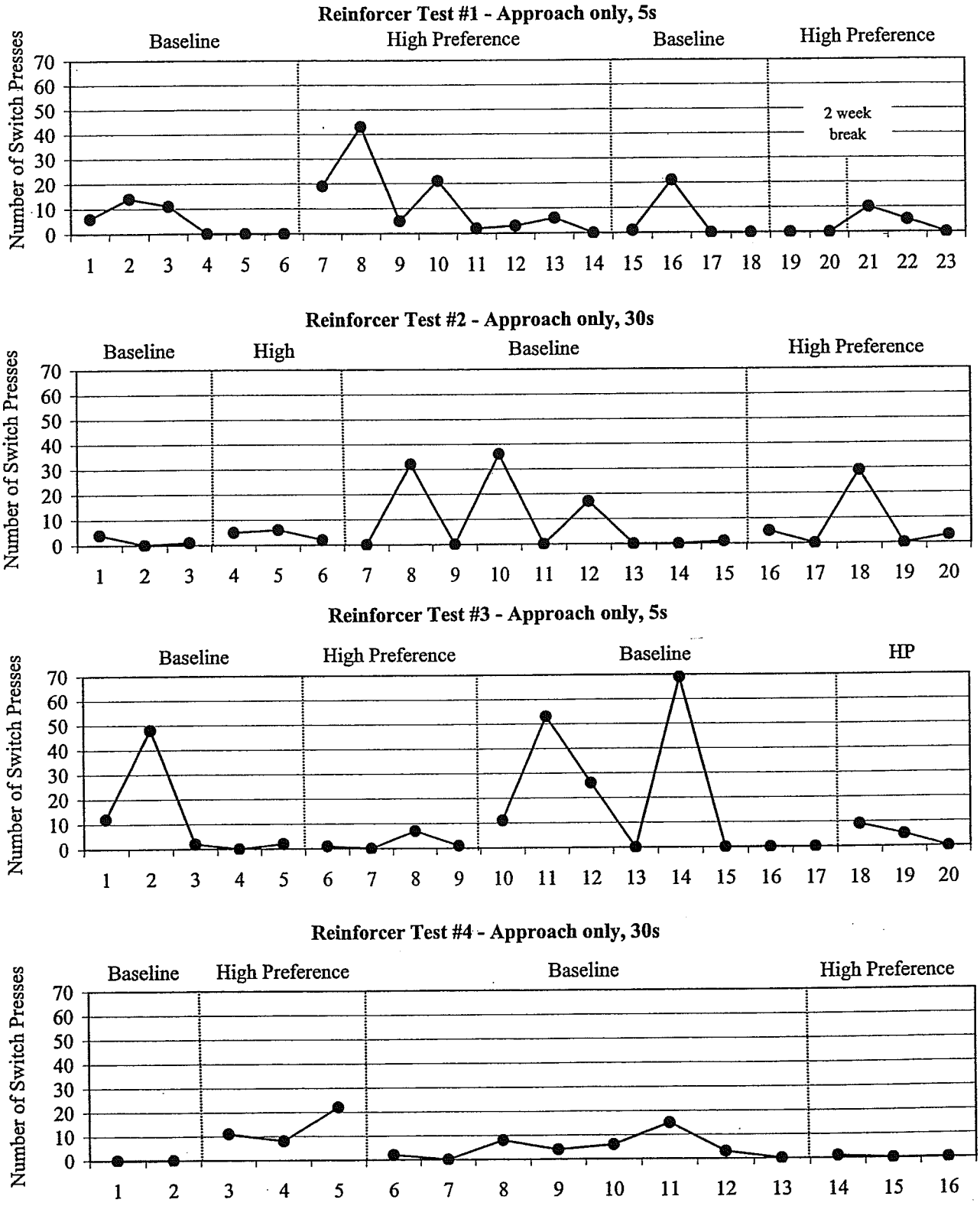

Figure J7. Reinforcer Test Results for Kelly.

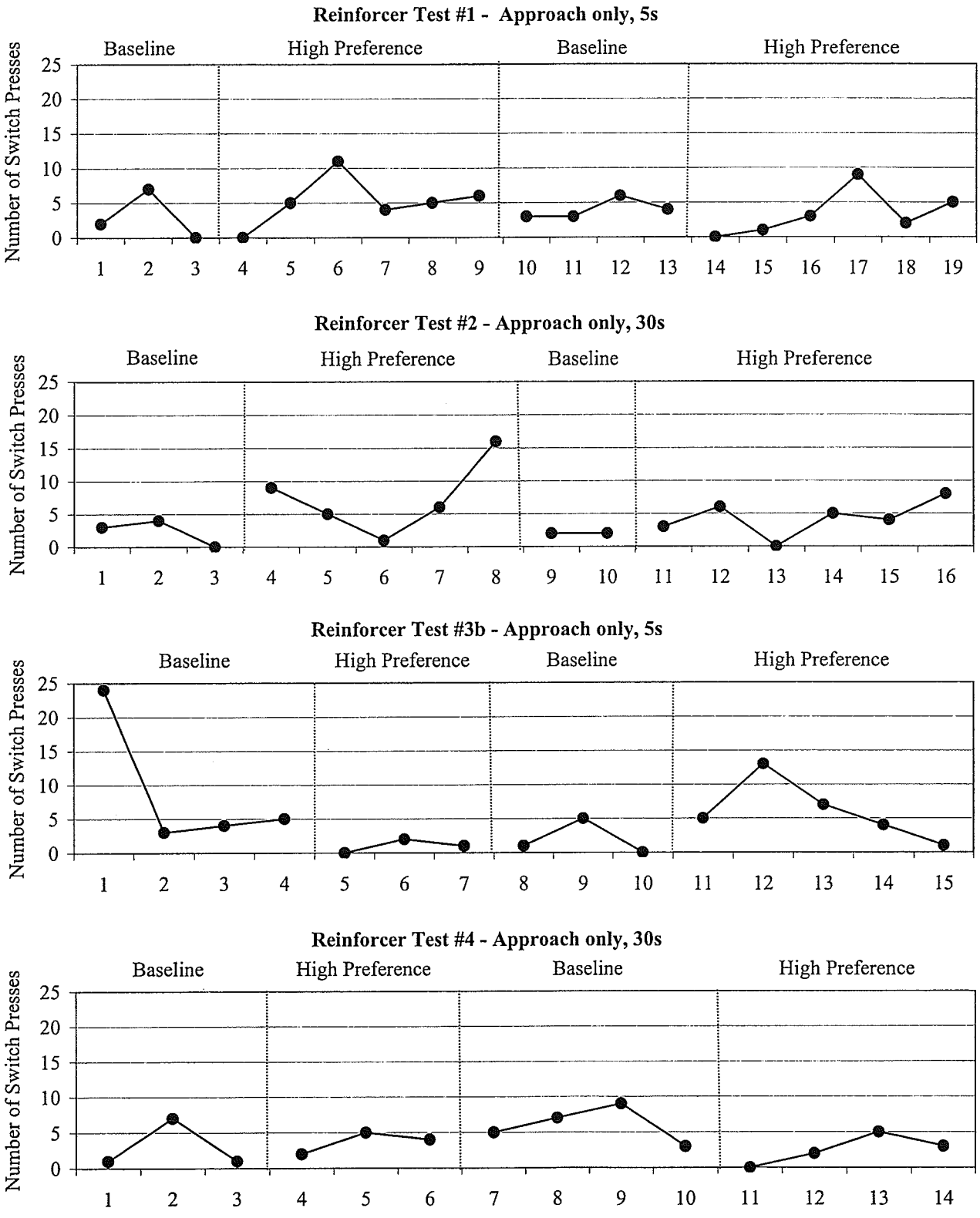

Figure J8. Reinforcer Test Results for Lester.