Comparing Two Methods to Promote Generalisation of Receptive Identification in Children With Autism Spectrum Disorders

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Author Note

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Abstract

Objective: The purpose of our study was to compare the effects of serial and concurrent training on the generalisation of receptive identification in children with autism spectrum disorders (ASD).

Methods: We taught one to three pairs of stimulus sets to nine children with ASD between the ages of three and six. One stimulus set within each pair was taught using concurrent training and the other using serial training. We alternated training sessions within a multi-element design and staggered the introduction of subsequent pairs for each participant as in a multiple baseline design.

Results: Overall, six participants generalised at least one stimulus set more rapidly with concurrent training whereas two participants showed generalisation more rapidly with serial training.

Conclusions: Our results differ from other comparison studies on the topic and indicate that practitioners should consider assessing the effects of both procedures prior to teaching receptive identification to children with ASD.

Keywords: autism, generalisation, multiple exemplars, concurrent training, serial training

Comparing Two Methods to Promote Generalisation of Receptive Identification in Children With Autism Spectrum Disorders

Introduction

One of the main challenges associated with teaching new concepts and skills to individuals with autism spectrum disorders (ASD) is their difficulties with generalisation [1-6]. Researchers have defined two main categories of generalisation: stimulus generalisation and response generalisation [7-9]. Stimulus generalisation is the process wherein an individual emits a newly learned behaviour in response to contexts or stimuli in the presence of which the behaviour was never taught whereas response generalisation refers to the process wherein an individual displays a variation of the taught behaviour in the presence of the initial stimuli [7]. Although both forms of generalisation are relevant to children with ASD, most prior studies have focused on stimulus generalisation and the current study will do the same.

For example, an individual with ASD who struggles with generalisation may learn to correctly receptively identify the word “cat” when shown a picture of a black cat, but fail to identify the same label when observing a white cat walking in a park. Given the limited utility of only emitting behaviour in the context in which it was learned, generalisation is a central issue in programs that aim to teach new concepts and skills to children with ASD [10]. Failure to generalise is thus a significant barrier to social integration and participation of individuals with ASD [8]. Stimulus overselectivity may explain why children with ASD often fail to generalise newly acquired behaviours [5]. That is, children with ASD may rely on unreliable cues when categorising stimuli, which may result in misclassification and hence difficulties with generalisation [6].

Researchers have shown that teaching a single exemplar of a concept is typically neither effective, nor efficient to observe generalisation [11]. An alternative strategy to promote generalisation of newly learned behaviour is to present multiple exemplars during teaching [7]. That is, the trainer varies the context or stimuli used to teach the new behaviour in order to promote generalisation. To be effective, the exemplars should be a representative sample of stimuli under which the child must emit the newly learned behaviour [11]. This representative sample will allow the child to create a stimulus class that include different variations of a concept or a situation that share common stimulus characteristics. The child will eventually be able to distinguish stimuli included in the stimulus class from others, which may explain the effectiveness of multiple exemplars training in comparison to teaching only one exemplar. Thereby, teaching multiple exemplars may increase the likelihood that the individual with ASD will engage in the behaviour in a new context or in the presence of a novel stimulus.

During teaching, these multiple exemplars can either be presented serially or concurrently [12]. In serial training, the trainer presents each exemplar one at a time; once an exemplar is mastered, another one is then introduced until a sufficient number of exemplars have been taught for the individual to demonstrate generalisation. If teaching the label "cat" to a child, the trainer would first introduce one exemplar of cat (e.g. a black cat). Once this exemplar of cat was mastered (i.e. the child correctly responded when shown this specific exemplar), the trainer would introduce a second exemplar of cat (e.g. a white cat). The trainer would continue teaching exemplars of cat sequentially (i.e. one at a time) until the child would correctly label cats that the trainer had never taught. In contrast, concurrent training involves the presentation of the multiple exemplars simultaneously at the onset of teaching; the trainer does not wait for an exemplar to be mastered before introducing a new one. Using the same case, the trainer would vary the exemplars from the onset (e.g. white cat, black cat, grey cat, tabby cat) and teach them simultaneously until the child could correctly label untrained exemplars of cat.

Numerous studies have shown that both serial and concurrent training may produce generalisation in individuals with developmental disabilities [13-18]. Comparing the two types of training is important as these two strategies are arguably the most often recommended to promote generalisation during discrete trial instruction [19-21]. However, only a handful of studies have compared the effects of serial and concurrent training on generalisation directly together [12,22-25]. The previous studies have examined the effects of both procedures on the generalisation of expressive language, imitation, and item location skills in children and adults with developmental disabilities. Each of these studies has shown that concurrent training led to more rapid generalisation of learned behaviour than serial training. A possible explanation for these results is that the individual is exposed more rapidly to multiple exemplars in concurrent training in contrast with serial training wherein the child has to reach a mastery criterion before being exposed to another exemplar.

For example, Schroeder and Baer [12] found that, even if the two methods were equally effecient in initially teaching imitation skills to children with intellectual disabilities, concurrent training lead to more rapid generalisation. Similarly, Ferguson and McDonnell [22] found that concurrent training was more effective than serial training in promoting generalisation of untaught grocery item locations to adolescents with severe disabilities. Moreover, their results showed that concurent training also produced more rapid initial acquisition of the target exemplars.

That said, the research literature is limited insofar as none of previous comparison studies have included individuals with ASD. Given that researchers have shown that individuals with

ASD have specific difficulties with generalisation, it remains unclear whether the relative effects of each strategy would differ within this population. Furthermore, data suggest that the conditional-only method is a more efficient and reliable procedure to teach receptive identification to children with ASD [26]. To our knowledge, no study has compared serial and concurrent training within conditional-only trials to teach receptive identification. From a clinical standpoint, it appears important to compare the effects of both strategies on receptive identification because it is a core skill often emphasised in early intensive behavioural intervention programs [19-21]. Thus, the purpose of our study was to replicate and extend previous studies by comparing the effects of both serial and concurrent training on the generalisation of receptive identification in children with ASD.

Method

Participants and Settings

Nine children between the ages of three and six years old participated in the research study. All of the participants were English speakers, had been diagnosed with ASD by an independent multidisciplinary team (which included a psychiatrist or a psychologist), and received early intensive behavioural intervention services from private clinics in their area. The sessions were conducted in these private clinics by trained therapists already working with the participants. Every session took place in a small room with only a table and two chairs. Except for the reinforcers and instructional supplies used during the sessions, no other materials were present in the room. Table 1 presents the characteristics of the participants as well as the target pairs of stimulus sets taught using each training procedure. It should be noted that the *T*-scores for the Childhood Autism Rating Scale (CARS-2) provided in the table represent the severity of autistic symptomology within a sample of children with ASD [27]. Lower scores represent children with ASD who generally had fewer and milder symptoms than those with higher scores. The first author completed all the CARS-2 questionnaires in collaboration with each child's therapist. Each clinic provided details relative to the approximate number of receptive identification concepts mastered by each child at the onset of their participation in the study by using the VB-MAPP [28].

Data Collection, Response Definition, and Interobserver Agreement

During each session, the therapist recorded whether the child responded correctly or incorrectly on each target trial. We defined correct responding as the child pointing or giving the corresponding image of the target stimulus set within 5 seconds of the therapist naming it. If the child pointed or gave an image other than the named stimulus set or if he or she did not point or give an image within 5 s, the therapist scored the response as incorrect. The therapist always considered the first image that the child touched: No self-correction was allowed. If the child touched two images simultaneously, the therapist scored the response as incorrect. We calculated a percentage of correct responding by dividing the number of correct responses by the total number of target trials in the session (i.e. 5) and multiplied the quotient by 100. To measure interobserver agreement (IOA), the first author also collected data on at least 30% of sessions for each participant across each phase, which were recorded on video. We calculated IOA by dividing the number of agreements by the number of agreements and disagreements, and then multiplying the quotient by 100. Mean IOA scores were 98% or above for each participant.

Procedures

We used a multielement design and conducted periodic generalisation probes to compare the effects of serial and concurrent training on the generalisation of the participants. Similarly to Stokes, Baer, and Jackson [29], the generalisation probes aimed to determine whether training resulted in the correct identification of untaught exemplars. For each participant, we taught the target stimulus sets in pairs (see Table 1). With most participants, we also integrated a multiple baseline across pairs of stimulus set. The target sets were words or expressions that the child did not identify correctly as evaluated in baseline sessions such as simple nouns, categories, actions, and prepositions. Each pair was composed of target stimulus sets with similar characteristics within the same class in order to control for difficulty level. We randomly selected one stimulus set within each pair to teach using serial training and we taught the other set with concurrent training. It should be noted that we inadvertently introduced two overlapping stimulus sets for Jim (i.e. duck vs. bird). As both were not mutually exclusive and to minimise carryover effects across the two categories, we used different exemplars for each stimulus set, and we did not use ducks as distractors when we taught birds and vice versa.

A series of baseline sessions were conducted prior the training session to assess whether the participants could receptively identify the stimuli. Following these baseline sessions for both stimulus sets within the first pair, we alternated the serial training sessions for one set with the concurrent training sessions for the other set within a multielement design. The introduction of the pairs for participants with two or three pairs was staggered within a multiple baseline design. That is, we only began teaching the second pair of stimulus sets when the child had a percentage of correct responding of at least 80% on three consecutive generalisation probes for at least one of the two stimulus sets within the first pair. If the participant showed generalisation on only one of the two stimulus sets, we still introduced the second pair, but continued teaching the set from the first pair on which we had not observed generalisation. The child’s participation ended when (a) he or she showed generalisation on both stimulus sets of the final pair, or (b) when he or she showed generalisation on one of two sets of the final pair and a minimum of five additional training sessions had been conducted for teaching the set on which we had not observed generalisation.

Although we had initially planned to teach three pairs for each participant, we had to exclude pairs when our results indicated that the child showed high levels of correct responding in baseline sessions, indicating that it was already mastered or that it had been learned outside sessions. Moreover, Allan and Phil only completed training on one pair before becoming unavailable (i.e. both stopped receiving services from the clinics in which the study was being conducted). As such, the actual number of pairs taught to each participant varied between one and three. The introduction of the second baseline was delayed (nonconcurrent) for two participants (i.e. Brad and Jim); we had to introduce new stimulus sets, which had not been initially tested, because the participants had mastered the other pairs outside the experimental setting. The therapists conducted four to eight sessions per day, two to five days per week, depending on the availability of each participant.

Baseline. Each baseline session contained five target trials. Each trial involved the presentation of a different exemplar of the target stimulus set. For each trial, the therapist placed three laminated pictures (approximately 8 cm by 8 cm) in front of the participant. One of these pictures represented an exemplar of the target stimulus set and the other two were pictures unrelated to the target and unknown to the participant. At the beginning of the trial, the therapist named the target stimulus set and the participant had 5 s to respond. During this phase, the therapist never prompted, nor reinforced the child’s responding on target trials to be sure that the child did not learn the stimulus set during these sessions. The five target trials were randomly alternated with five interspersed trials. These interspersed trial involved skills that the child had already mastered and which were not related to the current study. Correct responding on the interspersed trials resulted in the delivery of social praise. The therapist did not collect data on interspersed trials; their function was to maintain responding despite the absence of reinforcement on the target trials. The therapist completed a minimum of three baseline sessions prior to starting the training sessions. For the second and third pairs, baseline probes were presented every four to six days until the child had shown generalisation of at least one of two stimulus sets in the previous pair. Then, the therapist presented a series of at least three baseline sessions prior to starting the training sessions for the new pair.

Serial training. The serial training sessions were similar to the baseline sessions with four exceptions. First, the participant received a small piece of edible reinforcer or a tangible reinforcer (i.e. toy) for 10 s contingent on correct responding. The therapists identified the reinforcer used for each participant via a paired-choice stimulus preference assessment [30] prior to the start of the training sessions. Second, the therapist implemented an error correction procedure contingent on incorrect responding. When a participant responded incorrectly, the therapist repeated the label of the set and provided a gestural prompt (i.e. pointed the correct picture). Correct responses following the prompt were reinforced by social praise only. Third, the sessions lasted until 5 unprompted trials had been presented. Thus, the sessions could last longer than five trials when the child made one or more errors during responding. Because prompted trials were nearly always followed by a correct response, we did not count these trials when computing our percentage of correct responses as it would have inflated its value. Finally, the five target trials within each session all presented the same exemplar. The therapist introduced a new exemplar of the target stimulus set only when the child had responded correctly on 100% of the trials of the three previous training sessions.

Concurrent training. The concurrent training sessions were identical to the serial training sessions except that the five target trials within each session presented a different exemplar of the stimulus set. In other words, the therapist presented a different exemplar of the target set on each trial. The therapist also used the same reinforcer as used for serial training. The five exemplars remained the same during the entire duration of training.

Generalisation probes. The generalisation probes were designed to examine whether the participants demonstrated generalisation of receptive identification and could be conducted at different times during the sessions. The generalisation probes were similar to baseline sessions, but the exemplars included in the probes were never subsequently taught. That is, the five exemplars of each stimulus set presented during generalisation probes were different from those used in the baseline and training sessions. We never prompted or provided reinforcement contingent on correct responding for the exemplars within the generalisation probes. The therapist planned generalisation probes every 4 to 6 days. When the child showed correct responding on at least 80% of trials, probes were conducted more frequently in order to determine whether the generalisation criterion was met (i.e. three consecutive probes with correct responding at 80% or more).

Follow-up probes. For each participant, we conducted follow-up probes to verify whether correct responding on taught and untaught (generalisation) exemplars would persist once the child had met the generalisation criterion. These follow-up probes were presented in the same manner as baseline.

Analysis

In order to determine which procedures produced generalisation more rapidly, we used the number of trials until generalisation as our main dependent variable for our analysis.

Specifically, we compared the number of trials necessary for each participant to meet the generalisation criterion (i.e. correct responding on at least 80% of trials of generalisation probes for three consecutive sessions) for each stimulus set within a pair. To control for increased exposure related to the error correction procedure, we included both unprompted and prompted trials within this analysis. We considered that one training procedure was more effective than the other when the difference in the number of trials required to meet the generalisation criterion was more than 10. We used a difference of 10 trials as a cut-off as any smaller differences may have been artifacts of the procedures (e.g. order in which the sessions were conducted, marginal differences in target stimulus sets).

Results

Figure 1 presents the number of training trials until generalisation for each stimulus set within and across participants, and the number of exemplars taught during serial training. Overall, the participants showed three characteristic patterns of responding. Two of the nine participants showed more rapid generalisation of at least one stimulus set following serial training. Six participants showed more rapid generalisation of at least one stimulus set following concurrent training whereas one participant showed generalisation after approximately the same number of trials regardless of training procedures.

Insert Figure 1 about here

Two of the nine participants (i.e. Brad, and Jim) showed more rapid generalisation following serial teaching for at least one stimulus set (see Figures 2 and 3). The therapist needed to teach one to four exemplars serially for these participants to display generalisation. It should be noted that the asterisks on the graphs identify follow-up probes. We could not use a phase change line as, occasionally, one stimulus within the same panel (i.e., pair) was still in training while the other had already been mastered. Figure 2 shows that, on his first pair of stimulus set, Brad responded correctly more often during serial training than during concurrent training. He met the generalisation criterion following 89 trials for the stimulus set taught with serial training in comparison with 105 trials for the set taught with concurrent training. Correct responding during the follow-up generalisation probes was marginally higher for stimulus sets taught serially. Similarly to the first pair, Brad initially showed higher levels of correct responding during serial training for the second pair, and he also showed generalisation more rapidly following this method (48 trials for serial training vs. 66 trials for concurrent training). Figure 3 indicates that Jim responded correctly more frequently on the taught exemplars in serial training than those in concurrent training for the first pair of stimulus sets. He displayed generalisation after 85 and 124 trials following serial and concurrent training, respectively. For the second pair, responding on taught exemplars and generalisation probes remained similar regardless of training procedures. The percentage of correct responding was also similar across conditions during the follow-up probes.

Insert Figures 2 and 3

Six of nine participants (i.e. Leo, Matt, Tom, Sam, Allan, and Phil) showed generalisation more rapidly during concurrent training on at least one of the pairs (see Figure 4 to 8). Moreover, four of these participants never met the generalisation criterion for at least one stimulus set taught serially. Figure 4 indicates that Leo met the generalisation criterion for the first pair, but never achieved it following serial training despite the introduction of four different exemplars. He showed generalisation on the second pair of targets following approximately the same number of training trials. Responding on his follow-up probes remained high for all mastered stimulus sets. Figure 5 shows that Matt's responding on the first pair was similar across baseline, generalisation, and follow-up sessions. He demonstrated generalisation on the second stimulus set taught concurrently in 21 sessions less than the number of trials required to show mastery on the second stimulus set taught serially. Results of the follow-up show undifferentiated high levels of correct responding following both types of training. Figure 6 presents the results for Tom who never met the generalisation criteria on the two stimulus sets taught serially. He showed generalisation on the first and second concurrently taught set after 146 and 180 training trials, respectively. However, his responding on the follow-up decreased to baseline or near-baseline levels on both the taught exemplars and the generalisation probes.

Insert Figures 4, 5, and 6 about here

Figure 7 shows Sam’s responding on his three pairs of stimulus sets. For the first two pairs, responding during teaching remained similar across training procedures and Sam met the generalisation criteria in approximately the same number of trials. For the third pair, Sam never showed generalisation for the stimulus set taught serially, but met the criteria after only 73 trials of concurrent teaching. Responding on the follow-up probes was generally adequate (i.e. ≥ 80%) and remained undifferentiated across training conditions. Figure 8 presents responding for both Allan (upper panels) and Phil (lower panels). Allan showed generalisation more rapidly on the stimulus set taught concurrently than on the one taught serially and his responding remained high at follow-up. In contrast, Phil never showed generalisation on the set taught serially despite the introduction of nine exemplars. He did meet the generalisation criteria during concurrent training, but the results indicate that responding on the follow-up generalisation probes returned to near-baseline levels. Finally, a single participant did not demonstrate differential responding across training procedures. Figure 9 shows that Abby learned both taught stimulus sets after approximately the same number of trials, and her follow-up probes indicate that mastery and generalisation of these sets were maintained up to one month following the end of training.

Insert Figures 7, 8 and 9 about here

Discussion

Altogether, our results indicate that the most efficient method varied across participants. Serial training produced more rapid generalisation for 3 of 16 pairs taught whereas concurrent training was more rapid for 8 of 16 pairs. Both training procedures led to generalisation after approximately the same number of trials for the remaining pairs. The children who showed generalisation after the same number of trials for both training procedures never required more than four exemplars in serial training. Apart from marginal differences for Brad, we did not observe differential responding across training conditions for the follow-up probes. Furthermore, correct responding decreased during follow-up for two participants. One explanation may be that the absence of reinforcers for taught exemplars led to the extinction of the learned responses. In clinical settings, it would be recommended to continue providing reinforcers for correct responding during follow-up, which could alleviate this issue while strengthening both the learned and generalised responses.

To our knowledge, our study is the first to target receptive identification and to include children with ASD when directly comparing the effects of serial and concurrent training on generalisation. We showed that both procedures sometimes produced more rapid generalisation, which is not consistent with other studies using different targets and populations [12,22-25]. Specifically, our results indicate that some participants may benefit from the use of serial training. One hypothesis is that children who need fewer exemplars to show generalisation may be able to generalise more rapidly as the initial acquisition of each exemplar is more rapid than during the concurrent training wherein multiple exemplars are taught from the onset. These children may thus form stimulus equivalence relations more readily when the stimuli are presented sequentially. From a clinical standpoint, our results indicate that practitioners should first assess the effectiveness of both procedures in promoting generalisation prior to selecting a method for teaching receptive identification to children with ASD.

One of the limitations of the results is related to the characteristics of the participants in the current study. As we did not have a cut-off score, we had no control over the severity of autism within our sample. Specifically, the CARS-II scores indicated that the severity of autistic symptomology in our participants varied from mild to moderate. As such, our results cannot be applied to children who have more severe forms of autism. Nonetheless, it should be noted that the number of receptive words already mastered at the beginning of the study differed considerably across participants. A second limitation is that the difficulty of each stimulus set within a pair could have inadvertently differed. The same concern is applicable to the difference between the difficulty of the exemplar used for the teaching sessions versus those used in the generalisation probes. To control for this concern, we attempted to choose targets from the same class, we randomly assigned each stimulus set to the training procedures, and we taught more than one pair of sets to most of our participants. In the current study, we arbitrarily set the number of exemplars used during concurrent training at five. Although this procedure was effective with the participants, it remains unclear whether a lower number of exemplars taught concurrently would still produce generalisation, and if so, whether it would be more rapid than with more exemplars.

Another limitation is that the period of time between probes occasionally varied as we scheduled our probes based on the number of training days (rather than number of training sessions) and the number of daily sessions could vary based on circumstances outside of our control. For example, other learning activities sometimes took more time than anticipated or the parent picked up their child early, which sometimes led to variability in the number of sessions conducted between probes. Nonetheless, we ensured that generalisation probes for each stimulus set within a pair were conducted the same number of times and on the same days. Finally, we did not measure the quality of the treatment's implementation (i.e. integrity), nor examine the effects of intensity. Future research should consider these variables as moderators of the treatment's effectiveness.

In the future, researchers should attempt to replicate our study with children who have more severe forms of autism. Examining other teaching parameters (e.g. prompting, trial sequence, reinforcer type) on generalisation may also be important to support practitioners in improving their clinical practices. We also recommend that researchers conduct large group studies in which they could identify personal characteristics (e.g. severity of autism, age, IQ) that influence generalisation in children with ASD. Conducting a parametric analysis of the minimum number of exemplars necessary to produce generalisation during concurrent training also has the potential of contributing to the progression of research and clinical practices. In the end, examining procedures that promote more rapid generalisation should facilitate learning and thus improve the treatment of children with ASD.

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[Removed from manuscript for blind review; see title page]

Declaration of Interest

The authors report no conflicts of interest.

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Table 1. Characteristics and target stimulus sets for each participant

Participant	Age	CARS-II *T*-scores	Approx. number of mastered receptive identification words	Pairs of Target Stimulus Sets (serial/concurrent)
Brad	3	36	0	Hamburger/Egg Flashlight/Nail Clipper
Jim	5	30	900	In front/Behind Duck/Bird
Leo	5	45	350	School supplies/Cleaning stuff On top/Under
Matt	6	32	800	Shovel/Glove Fruit/Vegetable
Tom	3	52	2	Ball/Bloc Apple/Orange
Sam	4	37	75	Fence/Pillow Writing/Laughing In front/Behind
Allan	4	43	250	Thermometer/Accordion
Phil	3	35	100	Chair/Table
Abby	5	55	250	On top/Under

Note. CARS-II: Childhood Autism Rating Scale, Second Edition.

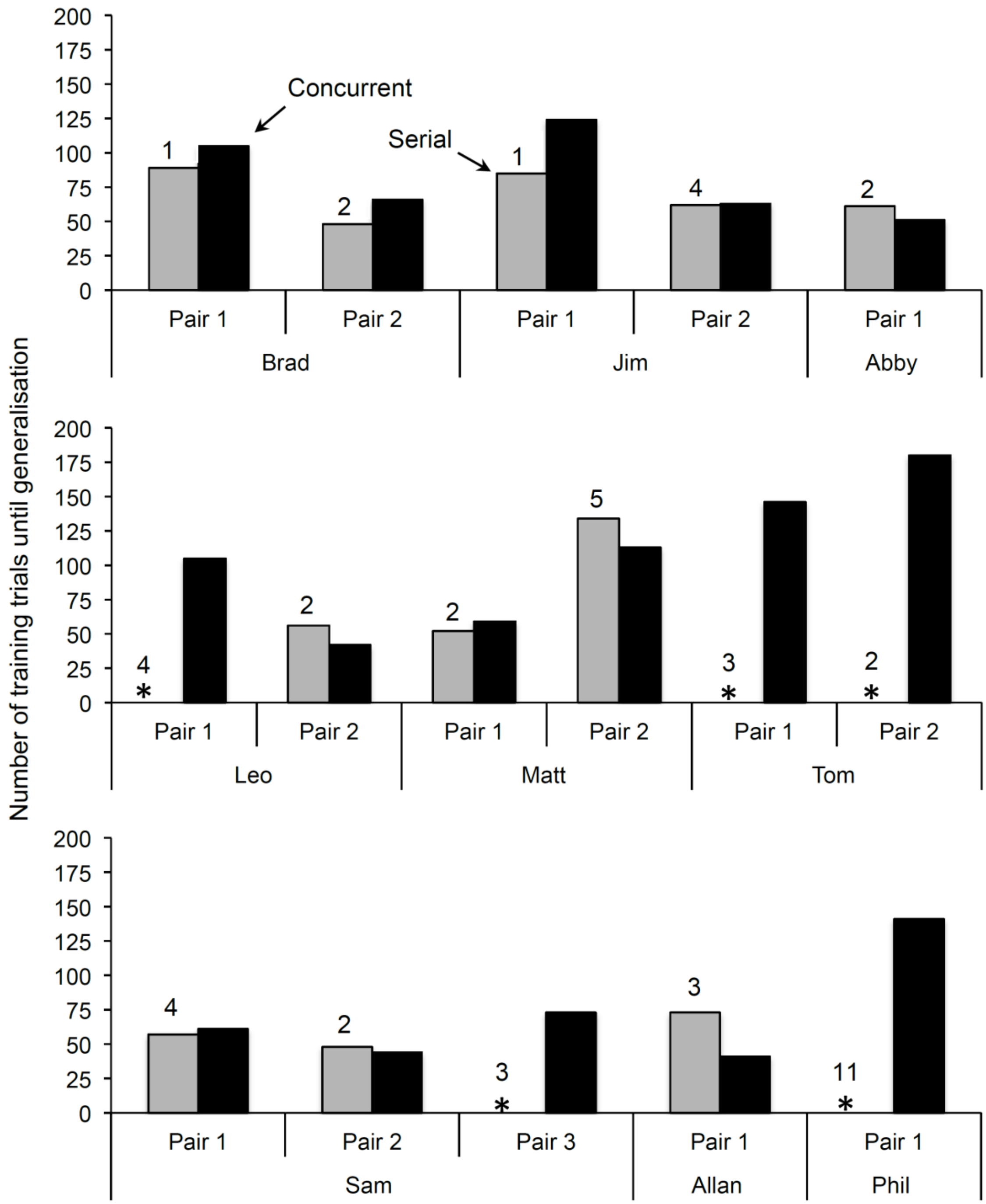

Figure 1. Number of training trials until each participant showed generalisation on the stimulus sets taught serially and concurrently. The numbers above the serial training columns identify the number of exemplars taught and asterisks denote stimulus sets on which the participants never showed generalisation.

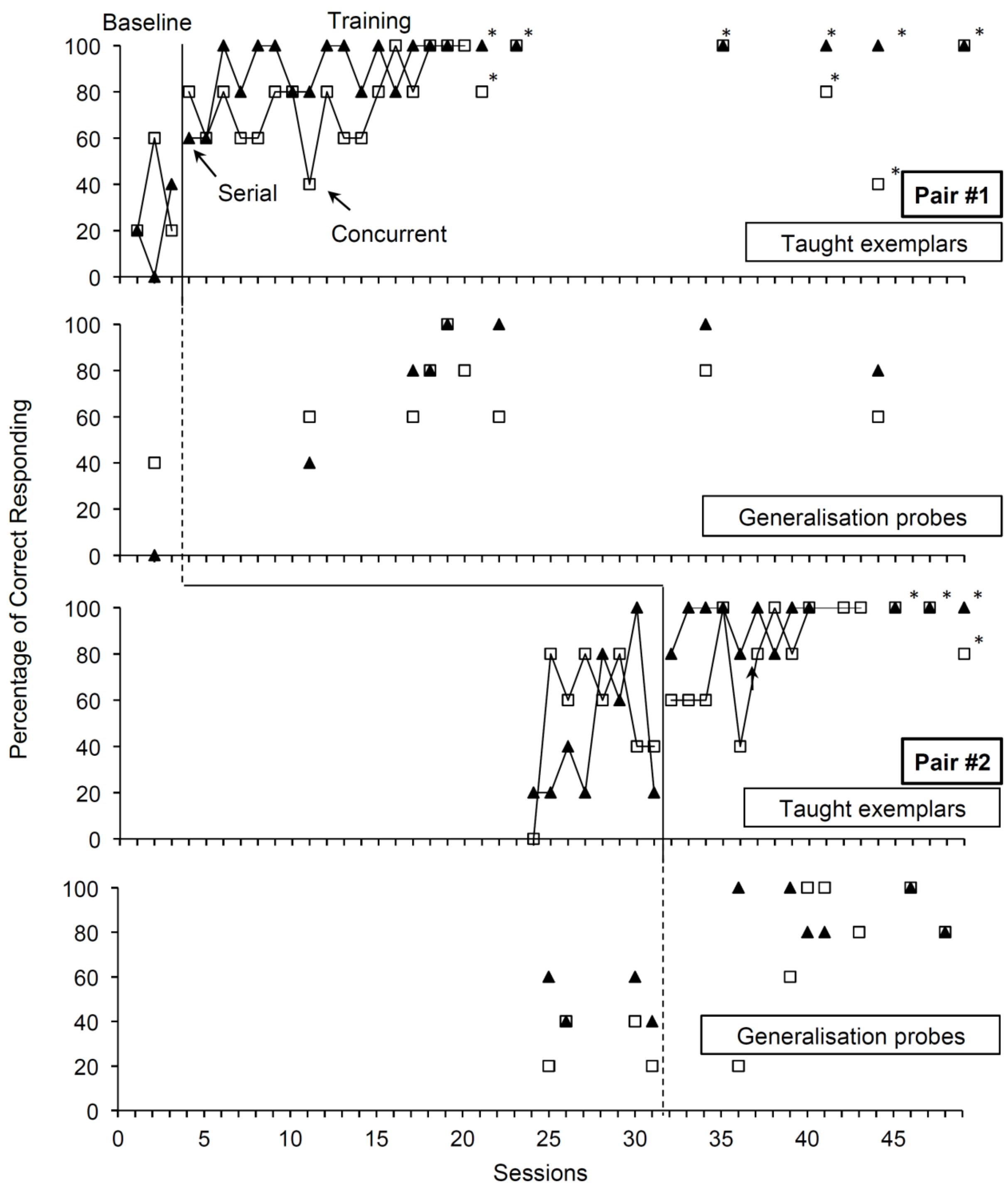

Figure 2. Brad's percentage of correct responding on taught exemplars and generalisation probes for each pair of stimulus sets. Unlabeled arrows denote serial training sessions wherein a new exemplar was introduced whereas asterisks identify follow-up probes.

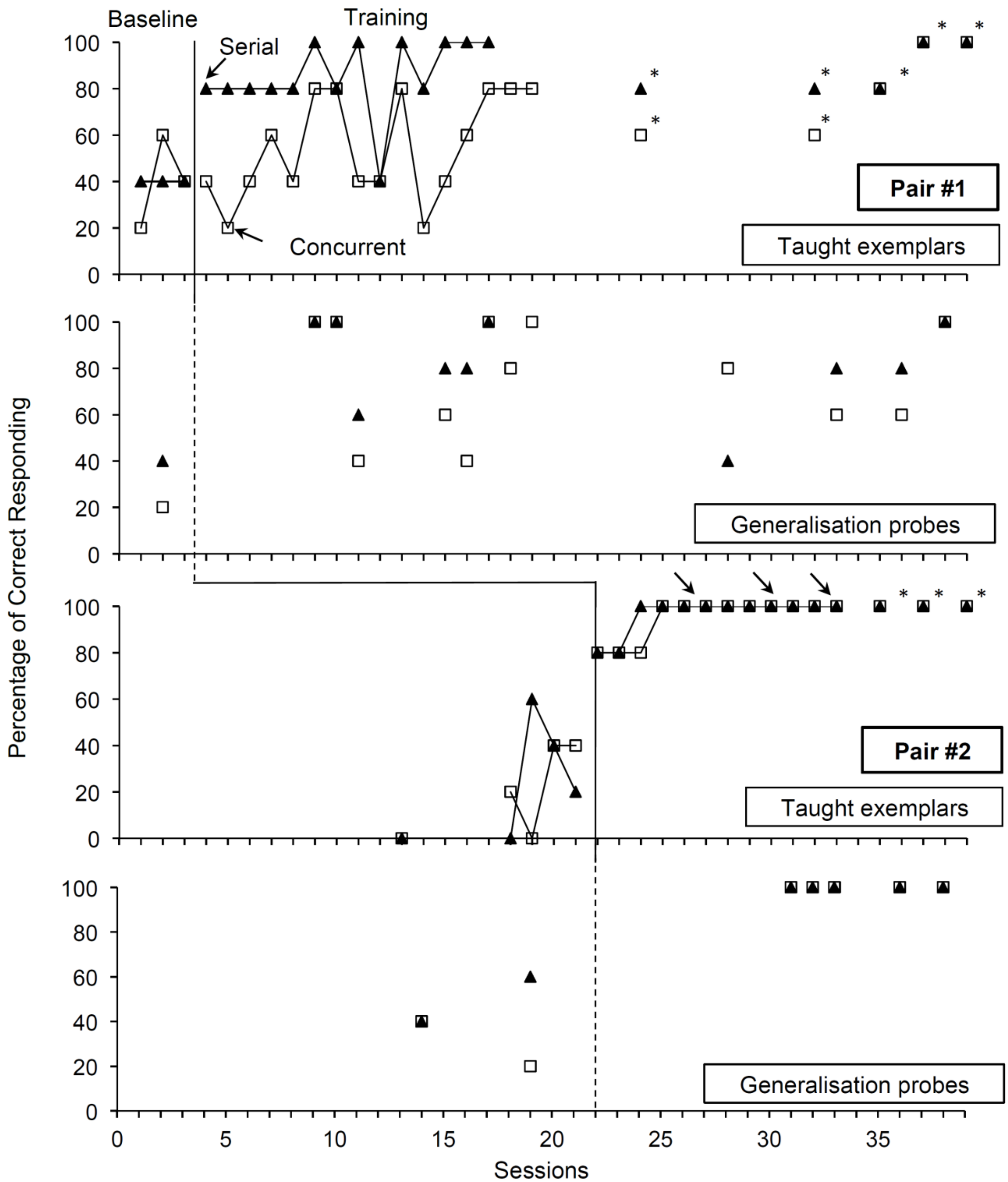

Figure 3. Jim's percentage of correct responding on taught exemplars and generalisation probes for each pair of stimulus sets. Unlabeled arrows denote serial training sessions wherein a new exemplar was introduced whereas asterisks identify follow-up probes.

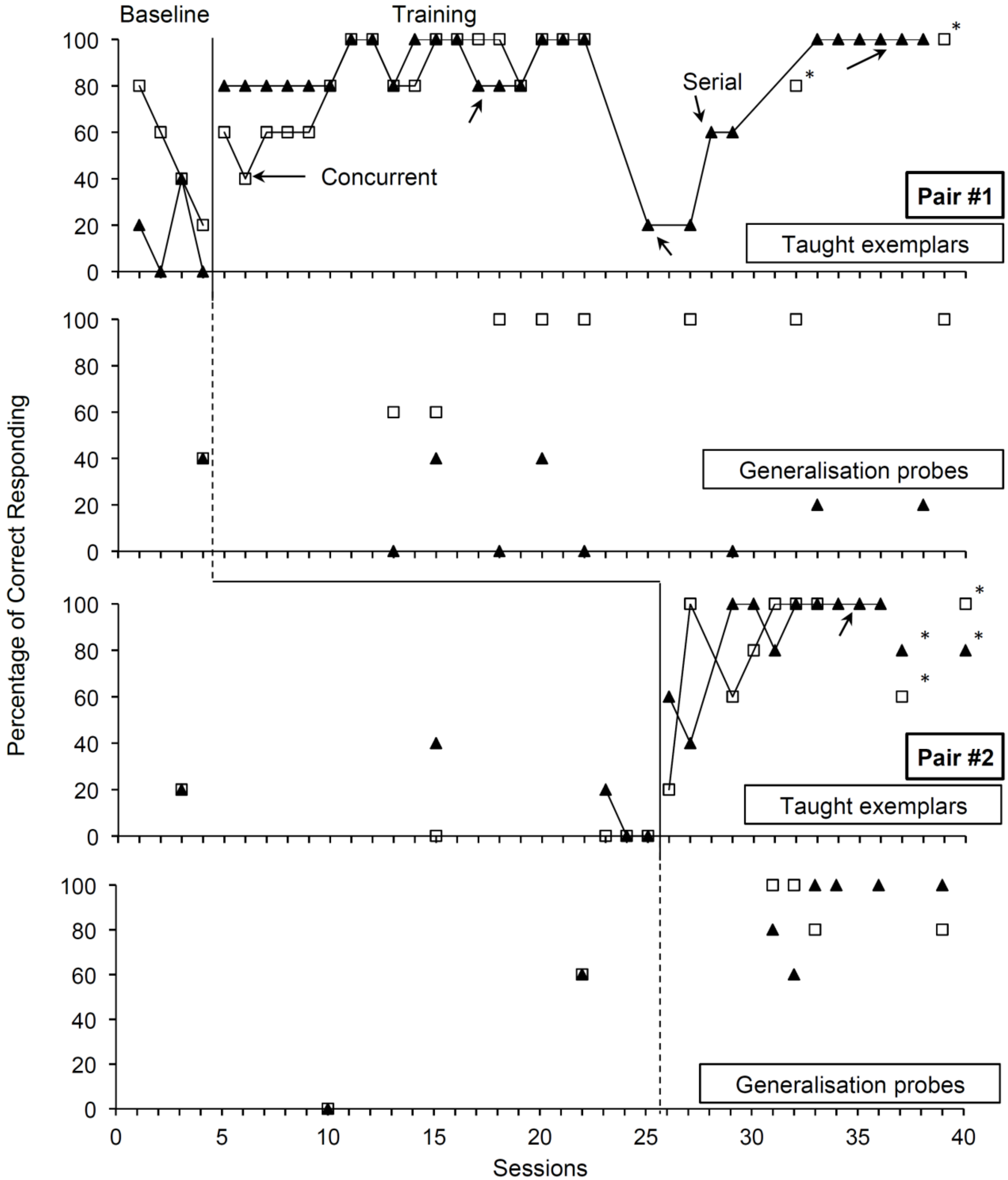

Figure 4. Leo's percentage of correct responding on taught exemplars and generalisation probes for each pair of stimulus sets. Unlabeled arrows denote serial training sessions wherein a new exemplar was introduced whereas asterisks identify follow-up probes.

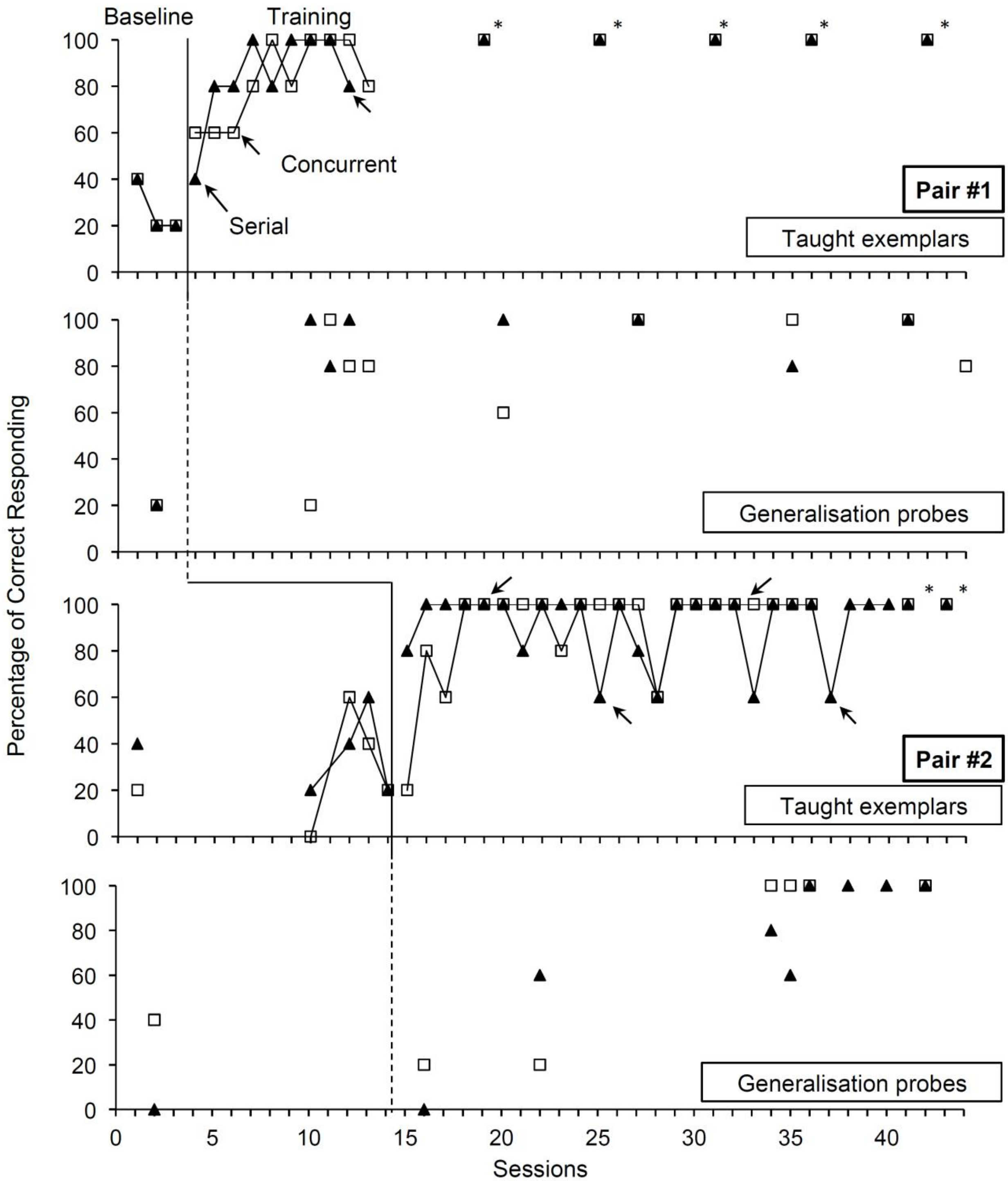

Figure 5. Matt's percentage of correct responding on taught exemplars and generalisation probes for each pair of stimulus sets. Unlabeled arrows denote serial training sessions wherein a new exemplar was introduced whereas asterisks identify follow-up probes.

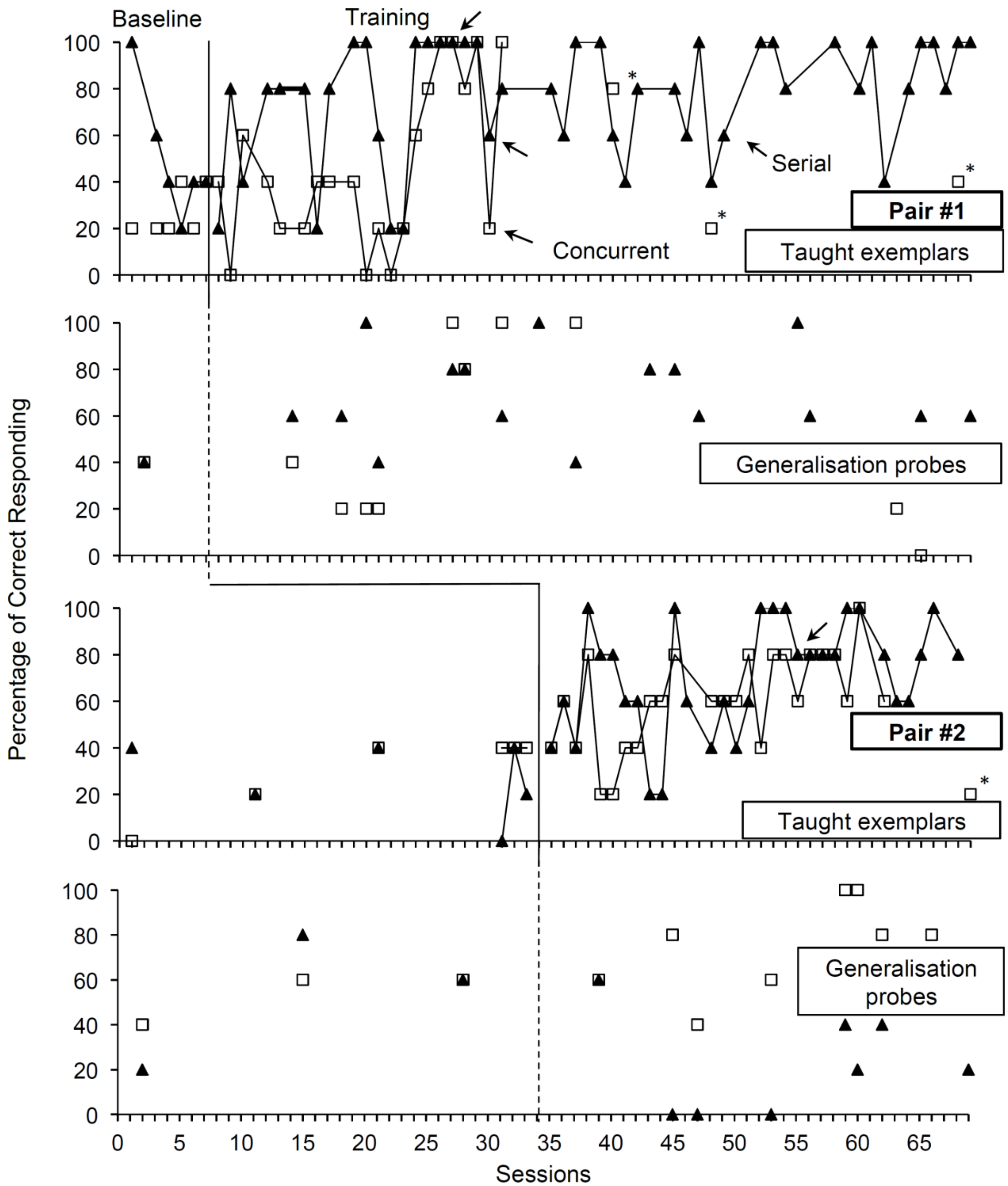

Figure 6. Tom's percentage of correct responding on taught exemplars and generalisation probes for each pair of stimulus sets. Unlabeled arrows denote serial training sessions wherein a new exemplar was introduced whereas asterisks identify follow-up probes.

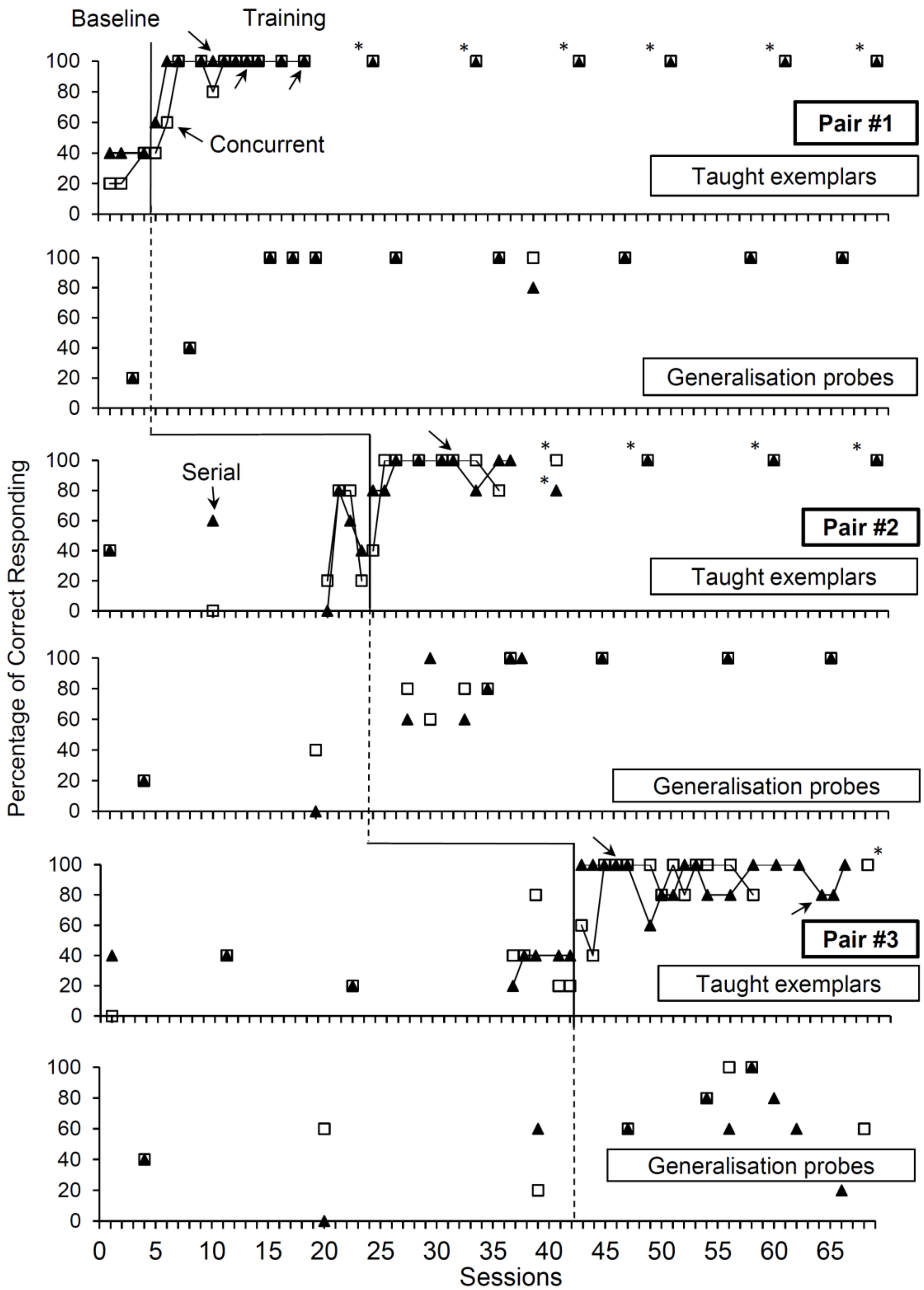

Figure 7. Sam's percentage of correct responding on taught exemplars and generalisation probes for each pair of stimulus sets. Unlabeled arrows denote serial training sessions wherein a new exemplar was introduced whereas asterisks identify follow-up probes.

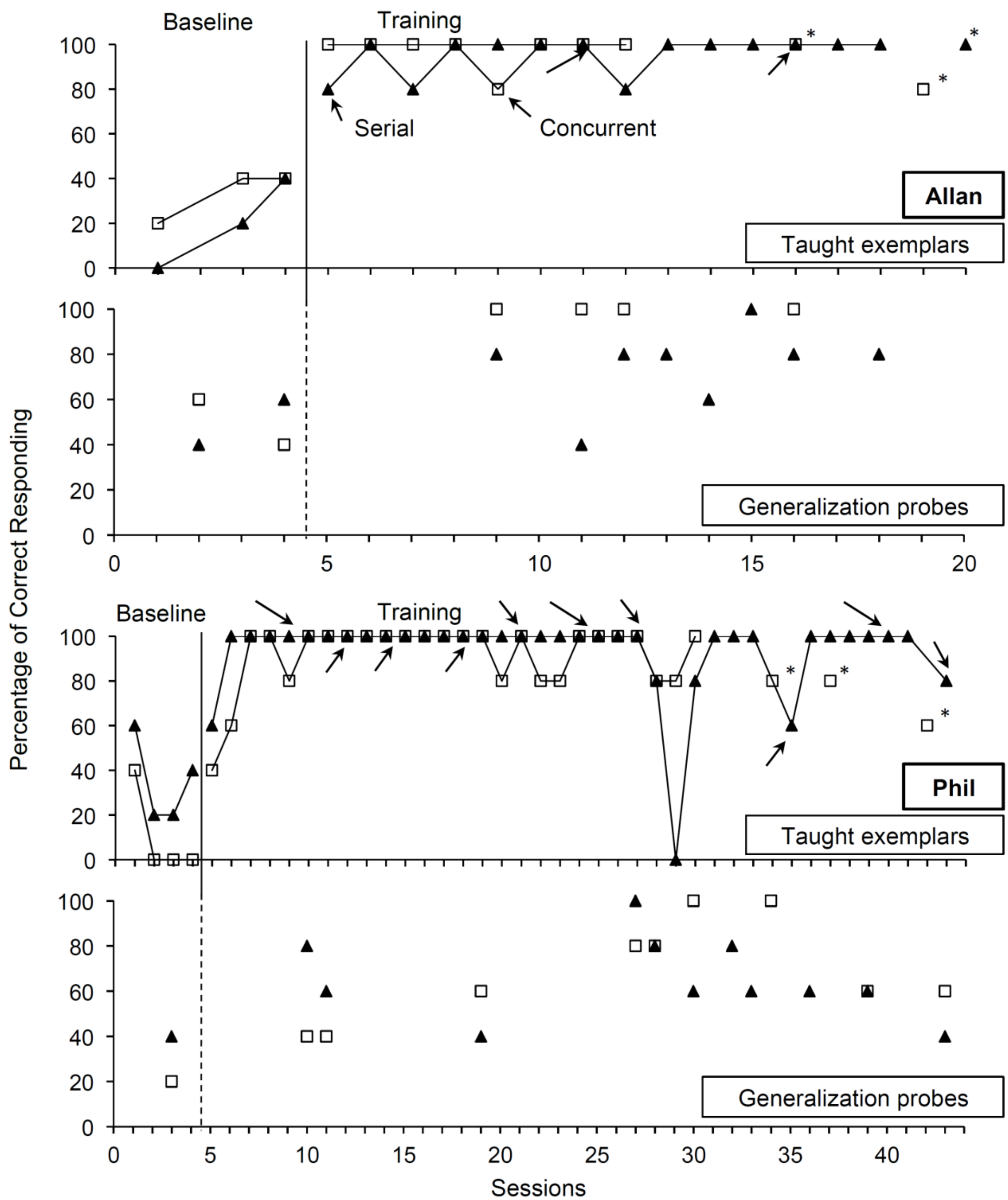

Figure 8. Allan's (upper panels) and Phil's (lower panels) percentage of correct responding on taught exemplars and generalisation probes. Unlabeled arrows denote serial training sessions wherein a new exemplar was introduced whereas asterisks identify follow-up probes.

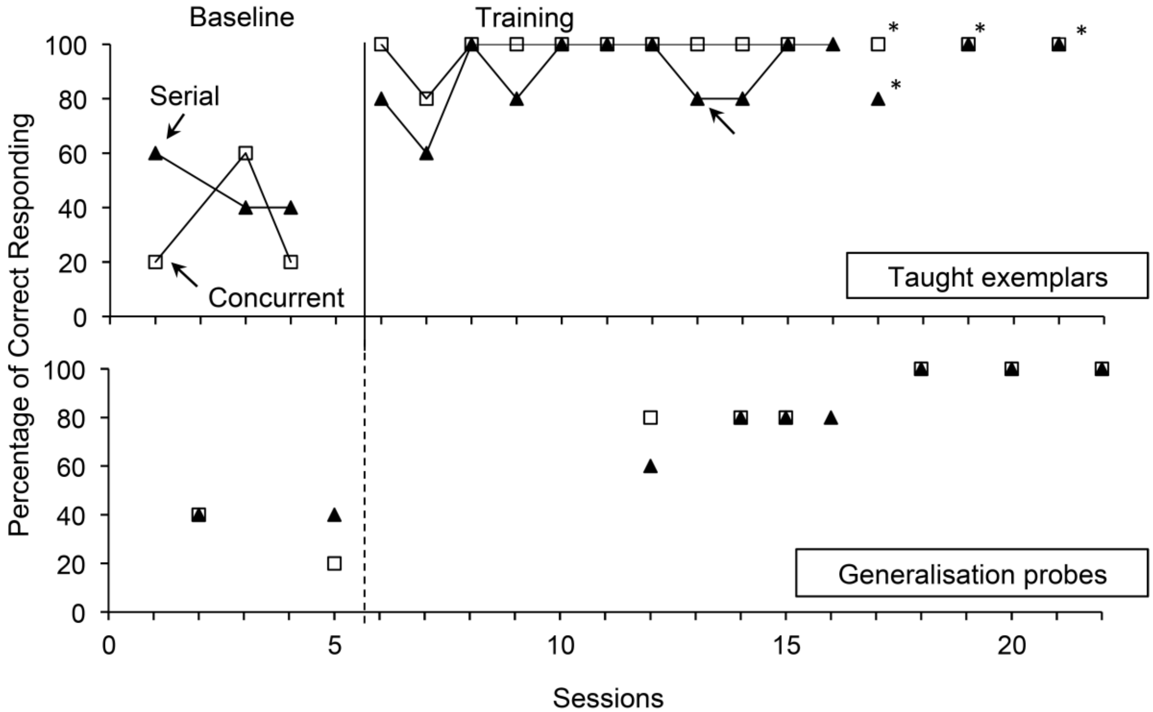

Figure 9. Abby's percentage of correct responding on taught exemplars and generalisation probes. Unlabeled arrows denote serial training sessions wherein a new exemplar was introduced whereas asterisks identify follow-up probes.