CHAPTER 4
RESULTS

4.1 Introduction

This chapter presents an overview of the results of the study. In order to orientate the reader, the list of terms pertaining to the experimental stage of the study is repeated here. Because procedural integrity and reliability of data coding need to be demonstrated before any conclusions about the effectiveness of the intervention can be made (Gast, 2010, p. 93), these aspects are presented next. Following this, the results are discussed according to the subaims formulated for the study (see Section 3.2.2). First, the effect of the intervention on symbol combination skills (intervention and generalization items) is discussed for each participant, ending with a summary of results across participants (Subaims i and ii). This is followed by an analysis to detect any possible influence of the type of semantic relation or the order of presentation on the results (Subaim iii). Lastly, an analysis of the structure of all correct responses is presented (Subaim iv).

4.2 Terms

Following a list of how terms are used in this study.

o **Probe**: Measurement of the dependent variable, that is, the production of graphic symbol combinations targeted during intervention, as well as the measurement of generalization to untrained items;

o **Probe test**: Picture description task used to measure the dependent variable as well as performance on generalization items;

o **Baseline probe**: Measurement of the dependent variable and generalization items before intervention commenced;

o **Intervention probe**: Measurement of the dependent variable and generalization items during the time when intervention was given;

o **Postintervention probe**: Measurement of the dependent variable and generalization items after intervention on the type of semantic relation had ceased;

- o *Intervention*: Independent variable or treatment, consisting of a prompting hierarchy used to prompt the production of selected combinations (intervention items) from the matrix during shared storybook reading (five items per story). In accordance with the design, the independent variable was applied consecutively to three behaviours (i.e. three types of semantic relations);

- o *Shared storybook reading*: Context used during which intervention was applied;

- o *Response during shared storybook reading*: Participants' responses to the various levels of prompting given during shared storybook reading were captured from the video recordings using data recording sheets (see Appendix A). Correct responses to the first level of prompting were graphed.

- o *Baseline phase*: Period of time during which baseline probes were administered;

- o *Intervention phase*: Period of time during which intervention and intervention probes were administered;

- o *Postintervention phase*: Period of time during which postintervention probes were administered.

4.3 Procedural integrity

The procedural integrity of a proportion of both the intervention sessions and probe test sessions was determined for each participant and each phase. An independent observer (speech language therapist) viewed between 20% and 33 % of video recordings of both the intervention procedure and the probe test for each participant across each of the phases, scoring the adherence to procedures using the score sheets (see Appendices T and U). The percentage of steps adhered to was calculated for each session. Detailed results per phase per participant are provided in Appendices V and W. A summary of the overall procedural integrity ratings of the intervention and probe test procedures is in Table 4.1.

Table 4.1

Overall Procedural Integrity of Intervention and Probe Test Across Participants

	Participant 1	Participant 2	Participant 3
Procedural integrity of intervention[a]	98.7%	98.3%	99.0%
Procedural integrity of probe test[a]	99.5%	100%	99.6%

[a] *measured by % of steps adhered to as rated by independent observer*

The procedural integrity of the intervention procedure varied from 96% to 100% across the three participants and the three intervention phases, with overall integrity ranging from 98.3% to 99%. The intervention procedure was thus reliably executed.

Procedural integrity of the probe test ranged from 99% to 100% across the three participants and the four phases (baseline phase and three intervention phases), with overall integrity of 99.5% to 100% for each participant across the different phases. Thus, the probe test was also executed reliably.

4.4 Reliability of transcription and data collected

The independent observer transcribed the participants' graphic symbol responses during the probe test for each of the video recordings observed, and classified each response as correct or incorrect. Point-by-point agreement of the transcription and the classification of responses per participant per phase was calculated. (Detailed results are provided in Appendix X). A summary of the overall point-by-point agreement of the transcription and classification per participant is presented in Table 4.2.

Table 4.2

Overall Point-by-Point Agreement of Transcription and Classification of Responses Across Participants

	Participant 1	Participant 2	Participant 3
Point-by-point agreement of transcription	88.2%	90.4%	86.5%
Point-by-point agreement of classification of responses	99.2%	100%	98.5%

Point-by-point agreement of the transcription per participant and per type of semantic relation ranged from 80% to 100% across the three participants across the phases, with overall reliability between 86.5% and 90.4%. There may have been a few reasons as to why the score was not higher. The interpretation as to whether a picture was deliberately pointed to or scanned with the forefinger in the process of finding the target was not always clear, and because no voice-over and confirmation of the intended message could be given during the probe test, the researcher was not able to confirm the

message produced by the participants. However, this only minimally affected the classification of responses. Point-by-point agreement of classification of responses as correct or incorrect per participant per phase and per type of semantic relation ranged from 93% to 100%, with an overall agreement of 99.2%. This represents overall good agreement and indicates that the classification was reliable.

4.5 Effect of intervention on the production of graphic symbol combinations

In this section, the effect of the intervention on the production of graphic symbol combinations (both intervention and generalization items) is discussed per participant according to a graphic portrayal of the results of the probes across the phases and the types of semantic relations targeted in intervention. Visual analysis of the graphs was supplemented by the calculation of the overall percentage of correct responses per phase, PND as well as IRD (comparing baseline and intervention phases). Appendix Y contains a summary of percentage correct, PND, IRD and corresponding CI per participant, per phase, for both intervention and generalization items.

Performance during the shared storybook reading activities (intervention) is also discussed to shed more light on the achievements of each participant. Results are then summarized and integrated with participant characteristics and contextual factors possibly influencing performance. The section concludes with a summary of the results across all three participants.

4.5.1 Participant 1

4.5.1.1 Performance as measured by probe test

Figure 4.1 presents an overview of Participant 1's performance on the probes administered during the baseline, intervention and postintervention phase for each target semantic relation.
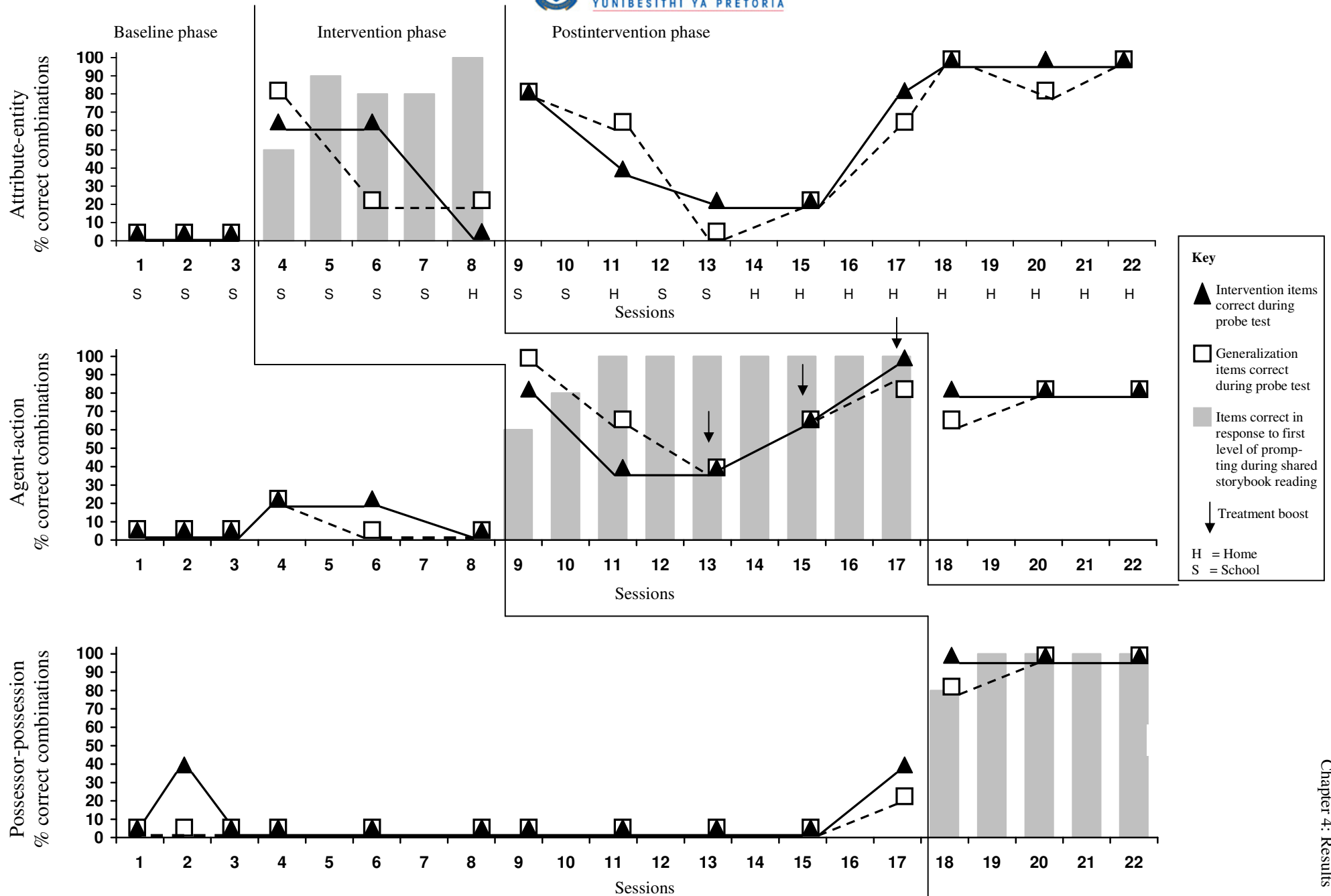
Figure 4.1. Percentage of correct symbol combinations expressed by Participant 1 across the three types of relations targeted.

Performance on both intervention items (white squares) and generalization items (black triangles) is depicted. Appendix Y gives a summary of percentage of items correct, PND and IRD with corresponding CI per phase.

4.5.1.1.1 Intervention items

A stable baseline of 0% across three sessions was obtained on the attribute-entity combination. When intervention was introduced, Participant 1's performance rose to 60% on the first intervention probe, signifying an immediate level change indicating that the intervention had an immediate effect. Participant 1 maintained this performance for the next probe, whereby the learning criterion was reached. However, another intervention probe was conducted in order to obtain three data points for the intervention phase. On the third intervention probe, his performance returned to 0%, resulting in an overall decelerating trend during the intervention phase. However, as this data point was regarded as an outlier, intervention on this type of semantic relation ceased and the next type of semantic relation was targeted. The PND when comparing the baseline and the intervention phase was 67%. Overall performance during intervention was 40% correct, as compared to 0% during baseline. Improvement rate difference (IRD) was .67, 85% CI [.33, 1.00].

On the first postintervention probe, Participant 1's performance reached 80% correct, representing an immediate change from his last performance during the intervention phase. However, as explained, this data point was regarded as an outlier. His performance of 80% correct represented an increase from the highest score obtained during the intervention phase (which was 60% correct). Over the next three probes, however, his performance declined to 40% and 20%. On the fifth postintervention probe, Participant 1's performance rose again to 80%, after which he maintained his performance of 100% over the following three probes. During the postintervention phase, an initial decelerating trend (Sessions 9-13) thus stabilized shortly at 20% (Sessions 13-15), after which a steep accelerating trend was observed (Sessions 15-18), stabilizing at maximum performance (100% correct) for three consecutive probes (Sessions 18-22). The PND of the postintervention phase as compared to baseline was 100%. Overall

performance during the postintervention phase was 68% of items correct, compared to 40% during intervention and 0% during baseline.

For the agent-action combination, the first three baseline probes remained at 0%. When intervention was introduced on the attribute-entity combination, performance rose to 20% for two probes, but returned to 0% on the last baseline probe. Thus, the intervention applied to the attribute-entity combination had little effect on the agent-action combination. Overall performance during this phase was 7% of items correct. When intervention was introduced, Participant 1's performance rose to 80% on the first intervention probe, representing an immediate level change indicating that the intervention had an immediate effect. His performance then declined to 40% on the next intervention probe. The treatment boost was therefore used for the remaining intervention sessions, whereby the correspondence between probe pictures and the story was made more salient. He scored 40% on the following probe, and his performance then increased again to 60% and 100%. After an initial decelerating trend during the intervention phase, an accelerating trend was observed over the course of the last three probes (Sessions 13-17). The PND between baseline and intervention was 100%. His overall performance during the intervention phase was 64% of items correct. IRD was 1.00, 85% CI [1.00, 1.00]. He maintained a stable performance of 80% on the three postintervention probes, giving an overall performance of 80% of items correct during this phase. The PND of the postintervention phase as compared to baseline was 100%.

The last type of semantic relation that was targeted was the possessor-possession combination. Of the 11 baseline probes that were conducted, Participant 1 scored 0% for 9 of them. He achieved a score of 40% for the second baseline probe (before intervention had been introduced to any of the combinations) and for the last baseline probe as well. His improved performance did not coincide with the introduction of intervention to either of the other two types of semantic relations, and it could therefore not be attributed to a response generalization. Overall, the baseline was regarded as stable, since 82% of the data points fell at 0%. The overall performance during this phase was 7% of items correct. After the introduction of intervention, Participant 1's score was 100% of

responses correct on the first intervention probe, a performance that was maintained during the second and third probe. His overall performance was thus 100% of items correct during intervention. An immediate level change after introducing intervention attests to the effect of the intervention. The PND between baseline and intervention was 100%. IRD was 1.00, 85% CI [1.00, 1.00].

The overall performance for the intervention phases was 67% of items correct and overall PND was 91%. Omnibus IRD (calculated by contrasting the overall improvement during all three intervention phases with the overall improvement during all three baseline phases) was .91, 85% CI [.82, 1.00]. These values suggest that intervention was very effective in promoting the production of graphic symbol combination skills (Scruggs & Mastropieri, 1998). For the postintervention phases (for the attribute-entity and agent-action combinations), overall performance was 71% of items correct. PND was 100%, indicating that intervention was very effective in promoting maintenance. It should be kept in mind, however, that both IRD and PND calculations are based on the degree of overlap between phases and therefore do not capture the magnitude of the change from baseline to intervention phases, nor the trend or stability of performance within a phase.

4.5.1.1.2 Generalization items

From a stable baseline of 0% across three sessions, Participant 1's performance on the generalization items of the attribute-entity combinations increased to 80% on the first probe conducted during the intervention phase and dropped to 20% on the next two probes conducted during intervention. Similar to his performance on the intervention items, the immediate level change after introducing intervention attests to its immediate effect on generalization items. However, a similar decreasing trend as for the intervention items was observed during this phase. Overall performance on generalization items during this phase was 40% of items correct. PND was 100% when comparing baseline and intervention. IRD was 1.00, 85% CI [1.00, 1.00].

During the postintervention phase, performance rose again to 80% during the first probe conducted, once again indicating a level change once intervention ceased. His

performance then decreased to 60% and 0% on the next two probes, returning to 20% on the fourth probe conducted during this phase. Thereafter, his performance rose to 60% and 100% on the next two sessions. He performed at 80% and 100% during the last two postintervention sessions. This performance mirrors the performance on intervention items, with an initial decelerating trend giving way to an accelerating trend over the probes conducted during Sessions 15-18, roughly stabilizing between 80% and 100% over the last three probes. Overall performance during this period was 63% of items correct. PND when comparing postintervention and baseline phases was 88%.

For the agent-action combinations, Participant 1's performance remained at 0% for the first three probes during the baseline phase and increased to 20% when intervention commenced on the attribute-entity combinations. Performance on generalization items returned to 0% during the fifth and sixth probe during the baseline phase. Overall performance during this phase was 3% of items correct. Once intervention commenced, Participant 1's performance on generalization items peaked at 100% on the first probe, indicating an immediate level change from minimum to maximum performance. His performance decreased to 60% and 40% during the next two probes of the intervention phase, and then increased again to 60% and 80% on the next two probes. This pattern of performance parallels the performance observed for intervention items of the agent-action combination, as well as that observed for the attribute-entity items during these sessions. Overall performance during this phase was 68% of items correct. PND as compared to baseline was 100%. IRD was 1.00, with a 85% CI [1.00, 1.00].

During the postintervention phase, he achieved 60% of items correct on the first probe and 80% on the following two probes conducted during this phase, representing a relatively stable performance over these three probes. His overall performance was 73% of items correct during this phase, and PND as compared to baseline was 100%.

Participant 1's performance on the generalization items of the possessor-possession combinations showed a stable baseline of 0% for 10 consecutive probes, with a performance of 20% on the last probe conducted during the baseline phase. Overall

performance during baseline was 2% of items correct. After intervention was introduced to this type of semantic relation, performance on generalization items increased to 80% on the first probe, representing an immediate level change. His performance rose to 100% on the next two probes. PND was 100%. IRD was 1.00, 85% CI [1.00, 1.00].

Overall performance was 67% and 65% of generalization items correct for the intervention and postintervention phases respectively, as compared to an overall performance of 2% of items correct for the baseline phases. Overall PND was 100% for the intervention phases, and 91% for the postintervention phases, indicating that the intervention was very effective to promote generalization to novel combinations, a skill that was maintained postintervention for the two behaviours on which postintervention data was collected (Scruggs & Mastropieri, 1998). Omnibus IRD was 1.00, 85% CI [1.00, 1.00], once again underlining that the intervention effectively promoted generalization to untrained exemplars.

4.5.1.2 Response during shared storybook reading sessions
Figure 4.1 also presents an overview of Participant 1's correct responses to the first level of prompting during the shared storybook reading sessions (grey bar graph). The first level of prompting consisted of drawing attention verbally and pointing to the picture, followed by an expectant time delay. The percentage of correct responses is captured in a bar graph (maximum number correct was 10, as each intervention item appeared twice). It should be noted that the absence of bars during baseline and postintervention sessions does not indicate a 0% performance, but rather that there was no measurement of performance since the shared storybook reading was only conducted during the intervention phase. A complete summary of the participant's responses to various levels of prompting is provided in Appendix Z.

From the bar graphs in Figure 4.1 it is clear that the percentage of correct items in response to the first level of prompting (verbally drawing participant's attention and pointing to the picture, followed by 10 s time delay) was generally high. An overall value of 80%, 93% and 96% respectively was attained for the first, second and third type of

semantic relation. The first intervention session for each of the three targeted relations showed the lowest percentage (50%, 60% and 80% respectively for the first, second and third relation that was targeted). Within a phase, the general trend was an increasing percentage of items correct in response to the first level of prompting with a maximum of 100% being reached after five, three and two intervention sessions respectively for the first, second and third relation. In case of the second and third relation, this performance (maximum number of items correct) was maintained for all ensuing sessions. Thus, it seems that Participant 1 produced the combinations after minimal intervention during the storybook reading sessions, responding correctly to the first level of prompting in at least half of the 10 opportunities provided. He also seemed to learn to produce the combinations increasingly quickly with each new type of semantic relation presented, indicating that the production of each type of relation seemed to be enhanced by the learning that had taken place during the intervention targeting a previous relation.

When comparing Participant 1's performance during shared storybook reading (limited here to percentage of items correct in response to the first level of prompting) with his performance during the intervention probes, he displayed a 10-20% better performance in the probes on the first intervention session of every type of relation. This indicates that, during the probe test, he was immediately able to produce the combinations targeted during intervention . The average difference across these three sessions was 17% increased performance in the probes as compared to the performance during shared storybook reading. During five sessions, Participant 1's performance was worse during the probes when compared to his performance during shared storybook reading, with differences in percentage correct ranging from 20%-100% and an average difference of 56%. Performance was identical (at 100%) during three sessions. On average, performance during shared storybook reading was 30% better than performance on the probes. While his performance seems comparable (20% or less difference in terms of percentage correct) for seven of the 11 sessions during which both the shared storybook reading and the probes were conducted, four sessions show a difference of 40%-100% in terms of percentage % correct, these being Sessions 8 (attribute-entity combination), 11, 13 and 15 (agent-action combination). There seemed to be factors

affecting Participant 1's performance during the probes conducted in these sessions. However, his performance during shared storybook reading was not affected.

4.5.1.3 Summary

Overall, IRD, PND, level change and overall performance on the probes indicate that the intervention was effective in encouraging Participant 1 to combine symbols to produce three types of semantic combinations. Furthermore, the intervention was very effective to promote generalization of this skill to untrained exemplars. The CIs obtained for the IRD values are generally very encouraging, with a zero interval being obtained for most IRD values obtained. The CI for the IRD obtained for the intervention items of the first type of relation that was targeted (attribute-entity) is relatively large, which may be attributable to the lower IRD obtained as well as the small number of data points obtained for baseline and intervention phases (Parker et al., 2009).

The postintervention data collected on two of the three types of relations furthermore suggests that ability to combine both trained and untrained exemplars was very effectively maintained postintervention. The overall performance was better during the postintervention phase than during the intervention phase for these two types of relations.

The slope change was a little less clear on the first two types of semantic relations. On the agent-action combinations, his performance decreased on the third probe during intervention and a decrease in performance on the second type of relation (attribute-entity) was seen during the second and third intervention probes as well. The decreased performance during Session 8 may have been influenced by the fact that this was the first session conducted at Participant 1's home in the afternoon, rather than at school in the morning. The novelty of the situation may have had a negative influence on performance. Subsequent sessions conducted at home (many also during the afternoon) did not seem to have the same negative effect on his performance. During Sessions 11, 12 and 13 Participant 1 was battling with a cold, which may have negatively affected his performance. It took Participant 1 much physical effort to access the pictures and he often

took a long time before he could accurately rest a finger on a symbol. He might have responded using single symbols rather than combinations in an effort to reduce fatigue. The fact that his performance on the agent-action combinations (postintervention) and the attribute-entity combinations (during intervention) mirror each other during these sessions seems to confirm that some external factors were influencing his performance. The treatment boost was thus used during Session 13, to make the correspondence between probes and intervention more salient. This seemed to have had a positive effect on performance on both types of relations, since in consequent probes, performance increased to maximum correct responses. For the attribute-entity combinations, this occurred during the postintervention phase, while performance on the agent-action combinations reached a maximum on the last intervention probe. Although his initial performance showed more variability (specifically Sessions 8, 11, and 13), his performance subsequently improved and stabilized at a high level, with very high performances across all types of relations (between 80% and 100%) observed from Session 18 onwards.

It is interesting to note that Participant 1's reduced performance on the probes during Sessions 8, 11, 13 and 15 was not mirrored in his performance during shared storybook reading (see Figures 4.2 and 4.3). It seems that performance during the probes was more vulnerable to outside influences. One reason may be that the shared storybook reading activity was more enjoyable and motivating. Contingent feedback given during this activity (as part of the intervention procedure) may also have helped to motivate participants to give correct responses. Probes were also always conducted after the shared storybook reading, thus making it more likely for fatigue to affect performance during the probes rather than during the shared storybook reading.

Participant 1 had a number of characteristics that may have contributed to his good performance (see Table 3.4, p. 67). Of the three participants, he had the best receptive English language scores; he also scored best in the receptive language subtests of the SERLA (Bortz, 1997). The fact that his speech and language development had progressed typically up until age 3 (when he had suffered a near-drowning incident) may

have given him a language base which children with congenital disabilities do not have. His speech was the most intelligible of all three participants, and he attained the highest scores for comprehension of the target relations and graphic symbols used in the study.

4.5.2 Participant 2

4.5.2.1 Performance as measured by the probe test

Participant 2's performance across baseline, intervention and postintervention phases on the intervention and generalization items of the three types of semantic relations is illustrated in Figure 4.2. A summary of percentage of items correct, PND and IRD with corresponding CI per phase is given in Appendix Y.

4.5.2.1.1 Intervention items

The first type of semantic relation that was targeted in intervention was agent-action. Participant 2's baseline performance was consistently 0% on all agent-action items. This remained unchanged during the first two intervention probes, representing no change in level—indicating that the intervention did not have an immediate effect. The treatment boost was applied implemented during the following sessions during which intervention probes were conducted. However, Participant 2's performance still remained at 0% for the next two probes, rising to 40% on the fifth intervention probe, at which time the teaching criterion was met and intervention ceased on this type of semantic relation. Change was thus only observed during the very last intervention probe. Overall performance during this phase was only 8% of items correct, and PND was only 20% as compared to baseline. IRD was .20, 85% CI [.00, .40], indicting that it was not possible to rule out the null hypothesis (IRD = 0) at an 85% level of certainty.

Performance during postintervention probes returned to 0% on the first two probes, but rose to 20% on the third postintervention probe. This probe coincided with the treatment boost employed for the second type of relation. The treatment boost might have had a carry-over effect, boosting not only performance on the type of relation receiving intervention, but also boosting performance on the type of relation that was
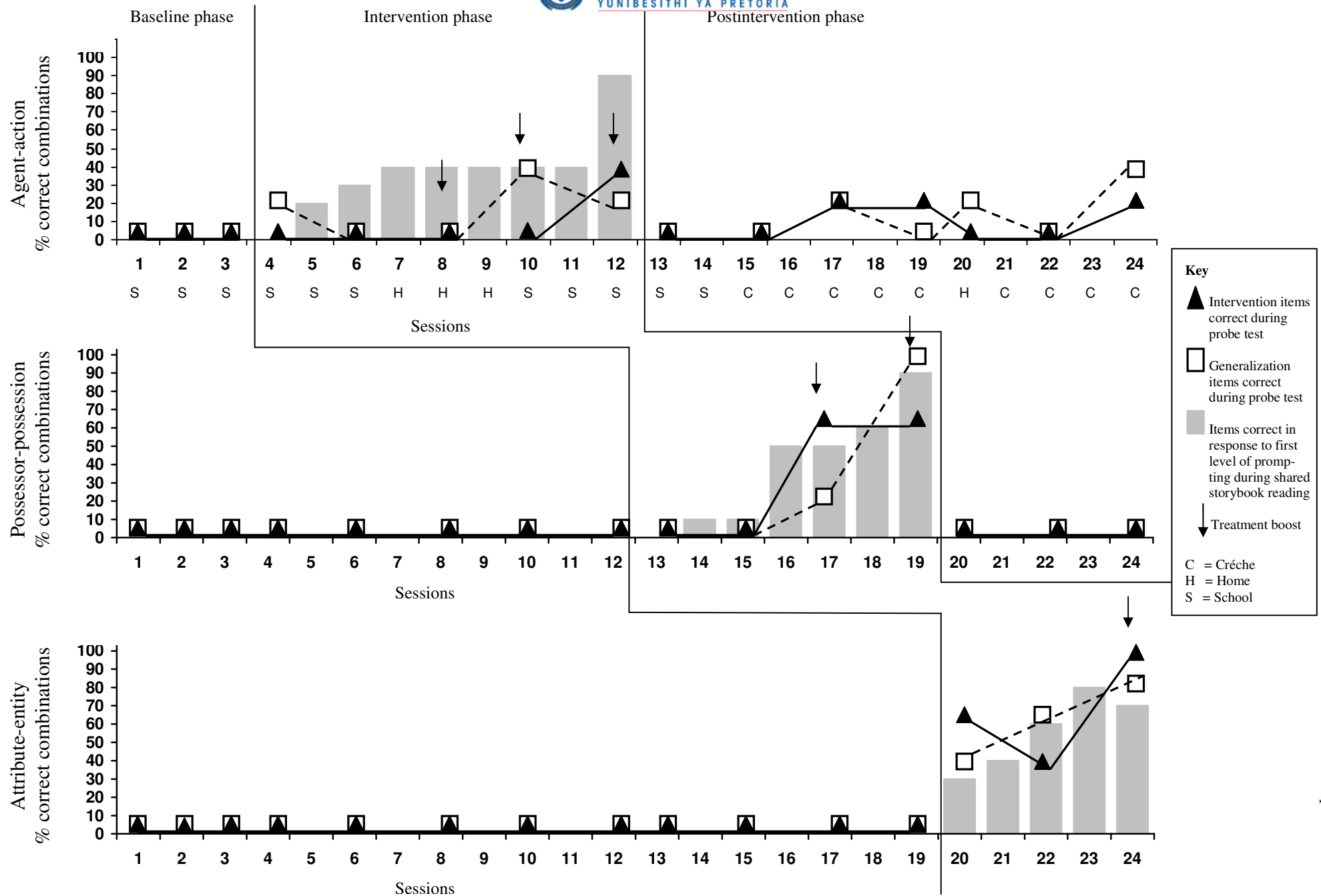
Figure 4.2. Percentage of correct symbol combinations expressed by Participant 2 across the three types of relations targeted.

targeted previously. His performance remained at 20% for the next probe, and then returned again to 0% for the next two probes, rising to 20% on the last postintervention probe. His overall performance was 9% of items correct during this phase and PND was 43%. Visual inspection of the graph shows very little effect for the intervention and postintervention phases.

On the possessor-possession combinations, Participant 2's baseline performance was once again stable at 0% across all eight sessions. Performance remained unchanged during the first two intervention probes, indicating no level change and no immediate effect of the intervention. The treatment boost was used during the next two probes. During the third probe, performance rose to 60%, and remained at 60% for the following probe. Thus, an accelerating trend was observed and overall performance was 30% of items correct. PND as compared to baseline was 50%. IRD was .50, 85% CI [.25, .75]. On the first postintervention probe, performance dropped to 0%, representing a level change of 60% in a negative direction. Performance remained at 0% for the next two probes—a return to baseline performance.

On the attribute-entity combinations, Participant 2 had a stable baseline of 0% across all 12 sessions. Once intervention commenced, performance rose to 60% on the first probe, representing an immediate change in level. Performance declined slightly to 40% on the next intervention probe. The treatment boost was thus used during the last intervention probe. Performance rose to 100% on the last probe. As only three data points were obtained, it is hard to identify a definite trend, although it is encouraging that his last performance was his best overall. Overall performance was 67% of items correct during this phase, and PND was 100%. IRD was 1.00, 85% CI [1.00, 1.00].

Overall performance during intervention phases was 30% of items correct, compared to 0% during baseline and 6% during postintervention. Overall PND during the intervention phases was 50%, indicating that the measurements obtained suggest an overall low effect of the intervention (Scruggs & Mastropieri, 1998). However, the effect clearly increased with each new type of relation being targeted. Omnibus IRD was .50,

85% CI [.33, .67]. Post-intervention PND for the first two types of relations was only 30%, indicating that the effect of the intervention was not maintained.

4.5.2.1.2 Generalization items

In general, Participant 2 performed similarly on the generalization items as on the intervention items, indicating a close link between these items. For the first type of relation (agent-action), Participant 2's performance on generalization items was 0% during baseline. After intervention commenced, his performance on generalization items rose to 20% during the first probe, indicating an absolute level change of 20%. However, his performance returned to 0% for the second and third probe occurring during the intervention phase. During the fourth probe, performance rose to 40%, and dropped to 20% during the last probe, which fell within the intervention phase. Performance thus remained variable, and no clear trend could be established. Overall performance was 16% of items correct, and PND was 60%. IRD was .60, 85% CI [.22, 1.00]. During the postintervention phase, performance dropped back to 0% on the first probe, representing a negative absolute level change of 20%. For the next five probes performance alternated between 0% and 20%, rising to 40% on the last postintervention probe. Performance thus remained poor and no clear trend could be established. Overall performance was 11% of items correct, and PND was 43% as compared to baseline.

Participant 2's performance on the generalization items of the possessor-possession combinations also showed a stable baseline of 0% across all eight sessions. His performance remained unchanged for the first two probes after intervention was introduced. No absolute level change was observed, indicating that intervention did not have an immediate effect. After introduction of the treatment boost, Participant 2's performance on generalization items rose to 20% and to 100% on the following two probes, indicating an accelerating trend. Overall performance during this phase was 30% of items correct, and PND was 50% as compared to baseline. IRD was .50, 85% CI [.25, .75].

His performance returned to 0% on the first postintervention probe, indicating a maximum negative level change (100%). Performance remained at 0% during the next two probes, indicating a return to baseline after intervention for the possessor-possession combinations ceased.

From a stable baseline of 0% across all 12 sessions on the generalization items of the attribute-entity combinations, Participant 2's performance rose to 40% on the first probe following the introduction of intervention targeting this type of relation. An absolute level change of 40% was thus observed. Performance further increased to 60% and 80% for the following two probes, resulting in an accelerating trend over this phase. Overall performance on generalization items was 60% of items correct, PND was 100% and IRD was 1.00, 85% CI [1.00, 1.00].

The overall performance during intervention phases was 32% of generalization items correct, as compared to 0% during baseline phases and 8% during postintervention phases. The overall PND during the intervention phase was 67% of items correct on generalization items across all three types of relations, indicating that intervention effect was low or questionable in terms of its success in promoting generalization to untrained items (Scruggs & Mastropieri, 1998). Omnibus IRD was .67, 85% CI [.50, .83]. Overall PND during the postintervention phases for items of the first two types of relations was 22%, indicating that the intervention was not effective in encouraging maintenance of a generalization effect observed during the intervention phase.

There were only minor differences between Participant 2's performance on generalization and intervention items with slightly better performance on the generalization items of the agent-action combinations; performance on intervention items of the attribute-entity combinations was slightly better. Once again, it seems that the matrix structure allowed any effect on intervention items to generalize to untrained exemplars from the matrix.

4.5.2.2 Response during shared storybook reading

Figures 4.2 also provides an overview of Participant 2's responses to the first level of prompting (drawing attention verbally and pointing to the picture, followed by an expectant time delay) presented during the sessions of shared storybook reading. These responses are captured in the grey bar graph. The maximum number correct was 10, as each intervention item appeared twice. As indicated for Participant 1, the absence of bars during baseline and postintervention sessions does not indicate a 0% performance, but rather that there was no measurement of performance as shared storybook reading was only conducted during the intervention phase. For a complete summary of the participant's responses to various levels of prompting please refer to Appendix Z.

Overall, Participant 2 did not respond correctly to the first level of prompting as often as the other two participants, with an overall performance of 38%, 39% and 56% correct respectively for the first, second and third type of relation. Like Participant 1, overall performance improved for each new type of relation that was targeted. The highest percentage correct that was reached was 90% during the last intervention sessions, targeting the agent-action and possessor-possession combinations respectively. Increasingly better performance across the sessions within a phase is evident, with the exception of a 10% decrease in performance from Session 23 to Session 24 for the attribute-entity combinations.

When comparing Participant 2's responses to the first level of prompting during shared storybook reading to his performance during the probes, the percentage of correct items was lower on the probes for seven of 12 sessions, with differences ranging from 10% to 70%. The average difference in performance for these seven sessions was 34%. Performance during the probes was better than that observed during shared storybook reading on three occasions (Sessions 17, 20 and 24). Notably, during Sessions 20 and 24, when intervention targeted the attribute-entity combinations, percentage correct on these combinations as tested by the probe test was 30% above the percentage correct in response to the first level of prompting during shared storybook reading. The average difference in percentage correct across all 12 sessions was 26% (with better performance

during shared storybook reading than during probes), representing the smallest average difference amongst the three participants.

In general, the trends in percentage correct on the probes across sessions mirrored the trends observed during shared storybook reading. On the agent-action combinations, the only increase in probe performance was observed from Session 10 to Session 12. Percentage correct in response to the first level of prompting during shared storybook reading similarly showed the most dramatic increase from Session 11 to Session 12. On the attribute-entity combinations the trends in performance during shared storybook reading versus probes was a little less congruent and showed a decrease in performance on the probes in Session 20 to Session 22, followed by an increase from Sessions 22 to 24. Performance during shared storybook reading increased from Session 20 to 23, followed by a slight decrease from Session 23 to 24. The overall increase is, however, observed in both the percentage correct achieved during shared storybook reading and during probes.

4.5.2.3 Summary

Level change, IRD, PND and percentage of items correct during the probes all attest to the fact that Participant 2 had initial difficulties acquiring the symbol combinations. However, his performance improved with each new type of relation. The treatment boost seems to have aided his performance, especially on the second type of relation, where an immediate change in performance was seen when the treatment boost was introduced. PND and percentage of items correct for the intervention phase increased from 20% and 8% on the intervention items of the first type of relation to 100% and 67% on the intervention items of the last type of relation respectively, and an immediate level change was only observed on the last type of relation. CIs (at 85% level of confidence) obtained for the IRDs for each of the three relations are increasingly more positive for each new relation that was targeted (increasingly narrower range). The 85% CI for the omnibus IRD of .5 is still relatively large [.33, .67].

Performance on generalization items showed a similar pattern of increasingly better performance across the types of relations, although an immediate level change (albeit slight) was observed upon the introduction of intervention on the first type of relation. PND on the first type of relation was relatively high (60%), but this score needs to be interpreted with caution in view of a low percentage correct score (16%) for generalization items during the intervention phase on the first type of relation.

IRD with accompanying CIs obtained for the first two types of relations indicate a lower effect and less confidence in the results at an 85% level (CIs are large) for generalization items. IRD values and CIs obtained for the last type of relation as well as overall are somewhat more encouraging, although the CI for the omnibus IRD is still wide, indicating reduced confidence in the results. The limited number of data points obtained as well as Participant 2's weak performance would have been partially responsible for large CIs.

Postintervention data gathered on the first two types of relations show little if any evidence of maintenance. On the agent-action combinations, a very limited number of correct responses (on intervention and generalization items) was observed postintervention, similar to the limited correct responses observed during intervention. On the possessor-possession combinations, postintervention data represent a return to baseline. The reason why Participant 2 did not maintain his performance on the possessor-possession combinations may be ascribed to the fact that fewer intervention sessions were conducted on this combination than on the agent-action combination.

Participant 2's performance during intervention seemed largely congruous with his performance during the probes in terms of trend. On the first type of relation (agent-action), the percentage of correct responses to the first level of prompting was generally higher than the percentage of correct responses given during the probes. He seemed to have some difficulty in producing the combinations targeted during intervention in the probe test. However, during intervention on the second type of relation (possessor-possession), his performance in response to the first level of prompting during

intervention mirrored his performance on the probes more closely. On the last type of relation (attribute-entity), he correctly responded to a greater percentage of items during the probe than he did during intervention (in response to the first level of prompting) on two of the three occasions on which the probes were conducted. Thus it seems that it became increasingly easy for him to produce the target and generalization items during the probe test.

Participant 2 had the lowest receptive English language score (as determined by the CELF–Preschool [UK] and PPVT-4) and was also the youngest participant. He also achieved the lowest score regarding the recognition of the PCS on the communication board (76% on the second trial). (For a summary of characteristics please see Table 3.4., p. 67) Additionally, the other two participants had had some experience (albeit limited) in using personalized communication boards and/or books with PCS for expressive purposes, whilst Participant 2 did not. The learning curve was thus understandably steep for him. On the initial three baseline probes, he responded mostly using mime, vocalizations and some word approximations. He only pointed to the PCS on the board on three occasions and only one of the PCS he pointed to was related to the picture shown. On the first probe after intervention commenced on the first type of relation, he responded by pointing to at least one correct PCS in response to 12 of the 30 pictures presented—once by pointing to the correct symbol combination, and 11 times by pointing to one PCS that was related to the picture shown. These graphic symbol utterances occurred in response to five agent-action pictures, five attribute-entity pictures and two possessor-possession pictures. Thus, Participant 2 learnt relatively quickly to point to single symbols, and slowly gained skills in combining symbols. The fact that he learnt to produce the combinations increasingly faster on each new type of relation that was targeted in intervention does seem to indicate that his understanding of the potential for PCS to be used to aid expression, increased. Furthermore, the matrix structure seemed conducive in helping him generalize his symbol combination skills to some combinations that had not been directly targeted in intervention. However, his lack of maintenance seems to indicate that his skills in the production of symbol combinations did not stabilize over the limited time during which the intervention was conducted.

4.5.3 Participant 3

4.5.3.1 Performance as measured by probe test

Figure 4.3 presents a graphic representation of Participant 3's performance across baseline, intervention and postintervention phases, for each of the three types of relations. Performance on both intervention and generalization items is depicted. Appendix Y gives a summary of percentage of items correct, PND and IRD with corresponding CI per phase.

4.5.3.1.1 Intervention items

From Figure 4.3 it is evident that Participant 3's performance during baseline was 0% on the first type of relation (possessor-possession) for all three probes conducted. Her performance remained at 0% during the first two intervention probes, indicating that the intervention did not have an immediate effect. The treatment boost was therefore used during the next probe, whereupon her performance increased to 20% on the next probe, and to 100% on the following probe. However, she returned to her baseline performance of 0% on the next probe, in spite of the treatment boost. During the next probe, the treatment boost was once again used, and her performance increased to 20%.

While a stable pattern of performance was observed during baseline, Participant 3's performance was erratic and variable during intervention, with no clear pattern being observed. While the intervention did seem to have an effect, no consistent trends could be discerned. Her overall performance during the intervention phase was 23% of items correct as compared to 0% during baseline. However, PND was only 50%. IRD was .50, 85% CI [.17, .83]. During the postintervention phase, an initial performance of 40% on the first probe returned to 0% for six of the remaining seven probes, only rising briefly to 20% on the sixth probe during this phase. Performance thus essentially dropped back to baseline, with overall performance at 8% of items correct, and PND at only 25% as compared to baseline.
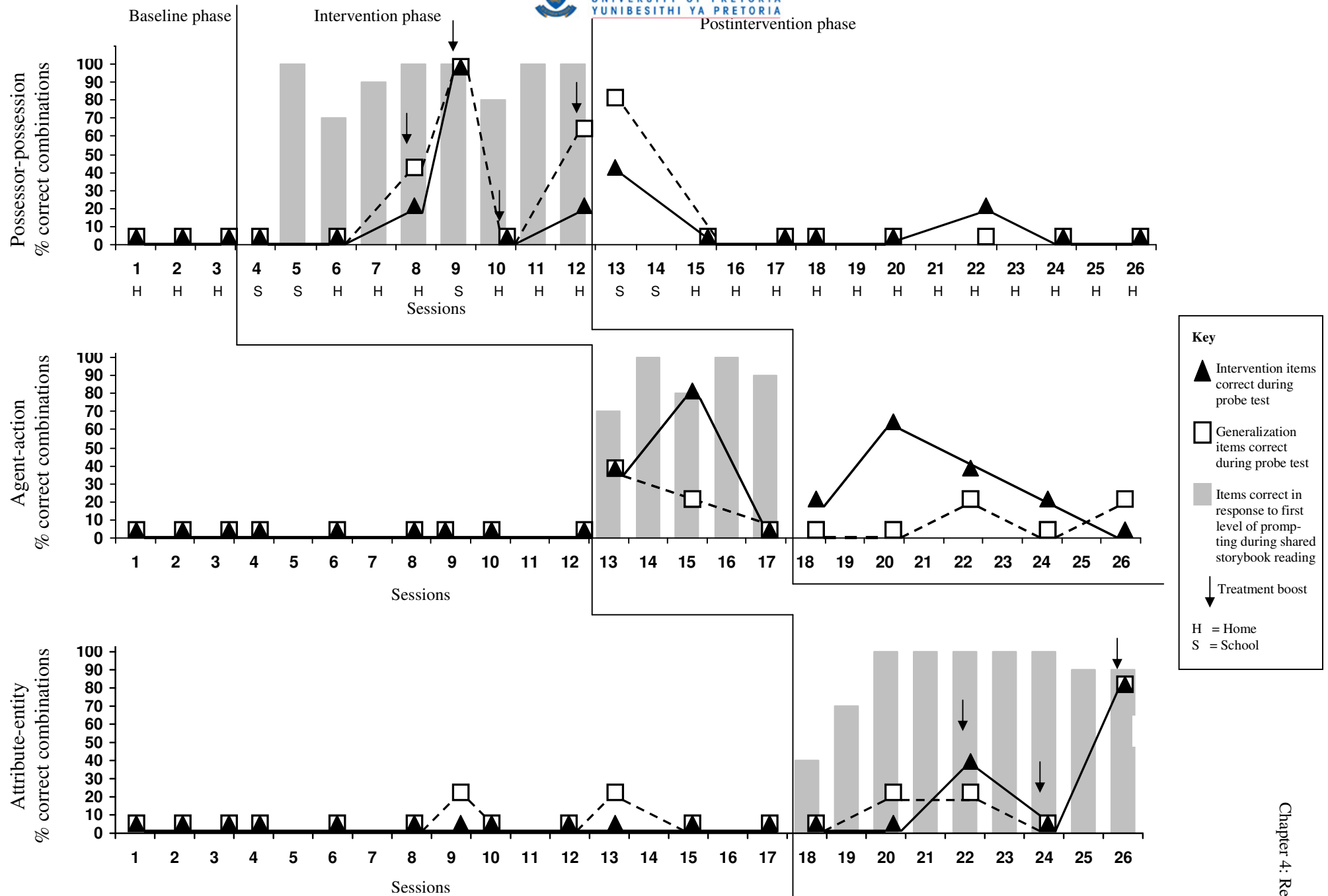
Figure 4.3. Percentage of correct symbol combinations expressed by Participant 3 across the three types of relations targeted.

On the second type of relation (agent-action), Participant 3's baseline performance was stable at 0% for all nine sessions. It increased to 40% on the first intervention probe, indicating an absolute level change of 40%. Her performance further increased to 80% on the second probe conducted during this phase, only to return to 0% on the third intervention probe. As she had technically reached the learning criterion (at least 40% above baseline average for two consecutive probes) during the second probe, intervention ceased on the second type of relation and commenced on the third. Her performance thus increased and decreased again over the three probes, but because only three data points were obtained, it is hard to identify a definite trend in intervention performance for this type of relation. Overall performance during intervention was 40% of items correct, and PND was 67%. IRD was .67, 85% CI [.33, 1.00]. On the postintervention probes, Participant 3's performance increased from 0% on the last intervention probe to 20% on the first postintervention probe, indicating an unexpected slight level change of 20%. She achieved 60% correct during the next probe, with performance declining thereafter to 40%; 20% and 0% on the next three probes. Once again, her performance was varied, with an initial accelerating trend giving way to a decelerating trend over the last few probes. Her overall performance during this phase was 28% of items correct, and PND was 80%.

Participant 3's baseline for the last type of relation (attribute-entity) was also consistently at 0% during all 12 baseline probes. Following the introduction of intervention, her performance remained at 0% during the first two intervention probes, indicating that there was no immediate effect of the intervention. The treatment boost was therefore implemented. Her performance increased to 40% during the next probe, only to return to 0% during the fourth probe. On the last intervention probe, her performance rose to 80%. Once again, performance showed great variability and no definite trends could be established. Her overall performance during intervention on this relation was 24% of items correct, and PND was only 40%. IRD was .40, 85% CI [.00, 0.80], the latter value indicating that it cannot be ruled out with 85% certainty that the true IRD is different from zero.

The overall performance during the three intervention phases was 27% of items correct, as compared to 0% during baseline and 15% during postintervention phases. The overall PND was 50% for the intervention phase and 46% for the postintervention phase, indicating that the

effectiveness of the intervention in promoting production of expressive graphic symbol combinations and the maintenance of this skill was low or questionable (Scruggs & Mastropieri, 1998). Omnibus IRD was .50, 85% CI [.29, .71].

4.5.3.1.2 Generalization items

In general, Participant 3's performance on generalization items mirrored her performance on intervention items closely. For the first type of relation (possessor-possession), a baseline performance of 0% was maintained for the first two probes conducted after intervention commenced. Once the treatment boost was implemented, she responded correctly to 40% of generalization items on the next probe and 100% on the fourth probe. Her performance dropped to 0% on the next probe, and rose again to 60% on the last intervention probe. Her performance thus varied in the same way as her performance on the intervention items for this type of relation did. Her overall performance on generalization items was 33% of items correct during this phase. PND was also 50%. IRD was .50, 85% CI [.17, .83]. On the first probe postintervention, Participant 3 responded correctly to 80% generalization item, after which her performance dropped to 0%, thus returning to baseline. Her overall postintervention performance was 10% of items correct, and PND was only 13%.

On the agent-action combinations, Participant 3's baseline performance was stable at 0% during all nine probes. Once intervention commenced, her performance increased to 40% on the first probe, indicating an absolute level change of 40%. Her performance declined again to 20% and 0% on the next two intervention probes, thus displaying a decelerating trend. Overall performance during this phase was 20% of items correct. PND was 67%. IRD was .67, 85% CI [.33, 1.00]. Participant 3's performance remained at 0% on the first two postintervention probes, increasing to 20% and returning to 0% on the following two postintervention probes. On the last probe of the postintervention phase, her performance was once again 20%. Performance was thus similar to baseline, with an overall performance of 8% of items correct, and PND of 40% as compared to baseline.

Participant 3's performance on the generalization items of the attribute-entity combination remained at 0% for 10 of 12 baseline probes, rising to 20% on the seventh and the

10th probe conducted during this phase (Sessions 9 and 13). The 10th probe coincided with the introduction of intervention on the agent-action combination. However, her performance returned to 0% on the remaining baseline probes. This can be regarded as a stable performance, since 83% of the data points fall at 0%. The overall performance on generalization items for this type of relation was at 3% of items correct during baseline. Upon introduction of intervention, her performance remained at 0% for the first probe, representing no level change. Performance increased to 20% for two probes, only to return to 0% on the fourth probe. On the last probe, she achieved 80% correct. Thus, the erratic pattern of performance on intervention items was mirrored once again on generalization items, with no clearly discernible trend. Overall performance was at 24% of items correct, with PND as compared to baseline being only 20%. IRD was .43, 85% CI [.12, .80].

Her overall performance during the intervention phases was 27% of items correct, as compared to 2% during baseline phases and 9% during postintervention phases. Overall PND was 43% for the intervention phases, and 23% for the postintervention phases, indicating that the intervention was not effective in promoting generalization to novel combinations (Scruggs & Mastropieri,1998). Omnibus IRD was .49, 85% C [.27, .70].

There was no remarkable difference in her performance on intervention versus generalization items on the possessor-possession combinations (although performance on generalization items was slightly better overall) and the attribute-entity combinations (where overall performance was identical). The difference was more marked on the agent-action combinations, where overall performance on intervention items was 20% better during both the intervention and the post intervention phases. The effect of the intervention on intervention and generalization items was thus very similar.

4.5.3.2 Response during shared storybook reading

Figure 4.3 also presents an overview of Participant 3's response during the shared storybook reading sessions. Specifically, the percentage of correct graphic symbol combinations in response to the first level of prompting (drawing attention verbally and pointing to the picture, followed by an expectant time delay) is shown in a bar graph (maximum number correct was 10,

as each intervention item appeared twice). Once again, the absence of bars during baseline and postintervention sessions does not indicate a 0% performance, but rather that there was no measurement of performance because the shared storybook reading was only conducted during the intervention phase. Appendix Z provides a complete summary of the participant's responses to various levels of prompting.

Like Participant 1, Participant 3 responded correctly to the first level of prompting (drawing participant's attention verbally and pointing to the picture, followed by 10 s time delay) during most opportunities created during shared storybook reading, with an overall percentage correct responses of 82%, 88% and 88% respectively for the first, second and third type of relation. Like Participant 1, the first intervention session for each of the three types of relations showed the lowest percentage correct (0%, 70% and 40% respectively for the first, second and third type of relation). Although the trend within a phase generally indicated increased performance with progressing sessions, there was some variation within Participant 3's performance, with a drop in performance here and there. During the intervention on the possessor-possession combinations, a 30% drop in performance was seen from Session 5 to Session 6 and a 20% drop from Session 9 to Session 10. A 20% drop was seen from Session 14 to Session 15 (agent-action combinations) and a 10% drop from Session 24 to Session 25. Between all other sessions, stable or increasing performance was observed.

While Participant 3's performance during shared storybook reading (as measured by percentage correct in responses to the first level of prompting) and the probes was identical during Sessions 4 and 9 (0% and 100% respectively), she consistently performed worse during the probes on all the other sessions. Differences in percentage correct ranged from 30%-100%. The average difference between shared storybook reading and probe performance was 53%. Some correspondence (albeit limited) in trend between performance on probes versus performance during shared storybook reading could be observed. For example, during the intervention phase that targeted the possessor-possession combinations, an overall increase in performance during both shared storybook reading and probes could be observed over Sessions 4 to 9, with a decrease from Sessions 9 to Session 10, followed by another increase from Session 10 to Session 12. Correspondence in trend was less clear for the intervention phases for the

agent-action and attribute-entity combinations. For the agent-action combinations, there was a general increasing trend in performance during shared storybook reading across Sessions 13 to 17, while performance on the probes increased from Session 13 to Session 15, but decreased from Session 15 to Session 17. Similarly, performance during shared storybook reading on the attribute-entity combinations increased from Sessions 18 to 20, stabilized at a maximum and decreased again slightly (from 100 to 90%) from Sessions 24 to 25, remaining at 90% for Session 26. Performance on the probes remained at 0% for Sessions 18 and 20, increased during Session 22, decrease again during Session 24 and increased steeply on Session 26.

It is clear that Participant 3's performance on the probes was generally much worse than her performance during shared storybook reading. In spite of some correspondence in trend, performance during shared storybook reading did not seem to be clearly related to performance during the corresponding probe.

4.5.3.3 Summary

From the results obtained it seems that the intervention did have some effect on Participant 3's production of target and generalization items, as can be seen by the increased performance on some of the intervention probes. However, the effect was neither consistent nor maintained. The most frequent response to the probe test items during both baseline and intervention was pointing to one rather than two target symbols. Participant 3 predominantly pointed to the symbols depicting agents, entities and possessions. The treatment boost seemed to have some effect in aiding her performance, as can be seen by change in levels in the first and third type of relation upon introduction of the boost. However, even with the treatment boost, performance remained variable with returns to 0% correct during Sessions 10 and 24. IRD values across intervention and generalization items for the different relations as well as omnibus IRD values range from .40 to .67 , and all accompanying CIs are wide, extending from .19 to .33 points below and above the obtained IRD values. The confidence in the results at a 85% level is thus limited. The limited number of data points as well as the small IRD values would have been responsible for wide CIs.

During intervention (storybook reading), however, Participant 3 responded correctly to at least 70% of all items upon the first level of prompting (drawing attention and expectant pause) during all sessions except for the first intervention sessions targeting possessor-possession and attribute-entity combinations respectively. It thus seems that, during the shared storybook reading situation, she quite readily combined the symbols to produce symbol combinations. However, it seemed difficult for her to transfer this skill to the probe test.

Various factors could have influenced Participant 3's performance. Most sessions were conducted at home in the afternoon, because Participant 3 was often kept out of school, remaining in bed for most of the morning. Her parents indicated that, during winter, with the cold weather conditions, it was difficult to get her ready for the school transport, which came to fetch her at 05h50 in the morning. When sessions were conducted at home, Participant 3 seemed to be somewhat less focused than when sessions were conducted at school. Sessions had to be conducted in the family lounge and, on occasion, family members would pass in the adjacent passage, although they endeavoured to keep this at a minimum. The repetitiveness of the probe test together with lack of specific feedback on the correctness of a response may also have influenced performance negatively. During a testing situation, only noncontingent encouragement can be given, to avoid the test itself becoming a learning situation. However, giving rewards (or encouragement) independent of performance may disadvantage the learning process (Basil, 1992).

While Participant 3 had better English receptive language skills than Participant 2, her motor abilities were significantly lower. She was also the only one of the candidates who did not have independent mobility. Her lack of mobility may have contributed to her being, in general, a more passive child than the other two participants were. Especially the seemingly sudden returns to 0% on intervention and generalizations items that occurred during intervention phases of all three types of relations (see Sessions 10, 17 and 24 on Figure 4.3) seemed to be linked to a lack of motivation to point to more than one symbol per response. Although she did always respond, she did not seem motivated to respond correctly, since pointing to two symbols took double the physical effort. Seeing that no negative feedback was given nor corrections were expected (unlike during shared storybook reading), there was no external motivation to respond correctly.

4.5.4 Summary of results across participants

Results as measured by the probe test differed considerably across the three participants. A clear overall effect of the intervention on symbol combination skills could only be shown for Participant 1, while the overall effect was low for Participants 2 and 3. On closer inspection of the visual portrayal of results, it seems that Participant 2, while struggling to produce the target combinations initially, learnt increasingly quicker and more with each new type of relation. Participant 3, however, showed erratic performance characterized by sharp increases and decreases in performance levels between sessions. While Participants 1 and 2 showed congruence between performance during intervention and performance during the probes, Participant 3 showed much less congruence, with overall performance during probes much lower than performance during intervention.

None of the participants showed much discrepancy between their performances on intervention items, versus their performances on generalization items on the probe test. This seems to suggest that, when the intervention had an effect on items that were specifically targeted, the effect readily generalized to other items in the matrix, which were not directly targeted. Postintervention data was only gathered on two types of relations per participant, limiting the conclusions that can be drawn from the data. Maintenance of skills postintervention was only demonstrated for Participant 1, while no or little such maintenance was shown for Participants 2 and 3.

While specific participant characteristics and contextual factors that may have influenced results have already been highlighted, these factors are further explored in the following chapter.

4.6 Influence of type of semantic relation and order of presentation

In order to gauge whether performance may have been influenced by the type of semantic relation and/or the order in which the semantic relations were targeted, the participants' performance was summarized according to both the order in which semantic relations were targeted (Table 4.3) and the type of relation (Table 4.4).

Table 4.3

Percentage of Correct Responses During Baseline (B), Intervention (I) and Post-intervention(PI)

Phases According to the Order in which Semantic Relations Were Targeted

Type of relations		Participant 1			Participant 2			Participant 3			Average		
		B	I	PI	B	I	PI	B	I	PI	B	I	PI
1st type of relation	Intervention	0	40%	68%	0	8%	9%	0	23%	8%	0	24%	28%
	Generalization	0	40%	63%	0	16%	11%	0	33%	10%	0	30%	28%
2nd type of relation	Intervention	7%	64%	80%	0	30%	0%	0	40%	28%	2%	45%	36%
	Generalization	3%	68%	73%	0	30%	0%	0	20%	8%	1%	39%	27%
3rd type of relation	Intervention	7%	100%	-	0	67%	-	0	24%	_	2%	64%	-
	Generalization	2%	93%	-	0	60%	-	3%	24%	_	2%	59%	-
Total	Intervention	6%	67%	71%	0	30%	6%	0	27%	15%	2%	41%	31%
	Generalization	2%	67%	65%	0	32%	8%	2%	27%	9%	1%	42%	27%

Table 4.4

Percentage of Correct Responses During Baseline (B) and Intervention (I) Phases According to

the Type of Semantic Relation

Semantic relations		Participant 1		Participant 2		Participant 3		Average	
		B	I	B	I	B	I	B	I
Agent-action	Intervention	7%	64%	0	8%	0	40%	2%	37%
	Generalization	3%	68%	0	16%	0	20%	1%	35%
Attribute-entity	Intervention	0	40%	0	67%	0	24%	0	44%
	Generalization	0	40%	0	60%	3%	24%	1%	41%
Possessor-possession	Intervention	7%	100%	0	30%	0	23%	2%	51%
	Generalization	2%	93%	0	30%	0	33%	1%	52%
Total	Intervention	6%	67%	0	30%	0	27%	2%	41%
	Generalization	2%	67%	0	32%	2%	27%	1%	42%

It appears that, overall, performance for both intervention and generalization items was best on the relations targeted last, and weakest on the first relation targeted. On closer inspection, this holds true for both Participants 1 and 2, whereas Participant 3 had a more even profile. For her, performance on intervention items was best on the second relation and worst on the first, with performance on generalization items being the best on the first relation and worst on the second. While Participants 1 and 2 thus seemed to achieve a consistent pattern of increasingly better performance, no clear pattern could be observed for Participant 3.

Analysis of the effect that the type of semantic relation had on the performance of participants does not show repeated patterns across any of the participants (cf. Table 4.4). The overall performance across participants does not differ substantially and in view of the lack of a uniform pattern across participants, the totals are not that meaningful. It seems that performance was not clearly influenced by the type of semantic relation and that the semantic relations (behaviours) were therefore equal in learnability, as required by a multiple baseline design across behaviours.

4.7 Further analysis of correct responses

All responses given during the probe test that were classified as correct were further analysed to determine to which extent they conformed to the word order and number of elements modelled during intervention. Results are presented in Table 4.5.

Table 4.5

Order and Number of Elements in Correct Responses across Participants

		Participant 1	Participant 2	Participant 3	*Total*
2 symbols	**Conforming order**	94 (60%)	25 (57%)	8 (14%)	127 (49%)
	Reverse order	31 (20%)	11 (25%)	26 (46%)	68 (26%)
More than 2 symbols		32 (20%)	8 (18%)	22(39%)	62 (24%)
Total		157 (100%)	44 (100%)	56 (100%)	257 (100%)

For Participants 1 and 2, the majority of responses that were classified as correct (i.e. containing both target symbols) contained only the two target symbols in the same order as modelled during storybook reading (60% and 57% respectively). The remaining responses were roughly equally divided amongst those containing the two target symbols in the reverse order (i.e. entity-attribute, action-agent or possession-possessor) and those containing more than two symbols. For Participant 3, the majority of responses contained the two target symbols in reverse order (46%), with nearly as many responses containing more than two symbols (39%). Only 14% of responses classified as correct contained the two target symbols in the same order as modelled during storybook reading.

An overview of the order and number of elements of the correct responses according to the type of semantic relation is given in Appendix AA. Each participant performed differently on the different types of relations and the type of relation did not clearly predispose a specific element order. Participant 1 performed similarly across all three relations, with the highest percentage of responses conforming to the order for the possessor-possession combinations. Participant 2 also had the highest percentage of conforming word order responses for this type of relation, clearly above the percentage of such responses for the other two types of relations. The agent-action relation elicited a high percentage of reverse order responses from him, while the other two types of relations elicited a minimal percentage or no reverse order responses. For Participant 3, the agent-action relation elicited the highest percentage of conforming word order responses, while the possessor-possession relation elicited a particularly high percentage of reverse word order responses.

4.8 Summary

The results of the study were presented in this chapter. Good procedural integrity was demonstrated by an independent observer. The data collection and analysis was shown to be reliable, judged by good interobserver agreement. The effect of the intervention on symbol combination skills (intervention and generalization items) was discussed per participant, ending with a summary of results across participants. Although participants performed relatively well during the storybook reading activities, their performance on the probes varied. An analysis to detect any possible influence of the type of relation or the order of presentation on the results indicated that two participants seemed to have learnt to produce the combinations more effectively with each new type of relation that was targeted. The type of relation did not seem to influence results. An analysis of the structure of all correct responses indicated that all participants used conforming and nonconforming word orders in their responses and responded with utterances that contained more than the two symbols that were modelled.