Chapter 4 Look closer.

The alertness of people with profound intellectual and multiple disabilities during multi-sensory storytelling: A time sequential analysis

Submitted as:

Ten Brug, A., Van der Putten, A., Penne, A., Maes, B., & Vlaskamp, C. Look closer. The alertness of people with profound intellectual and multiple disabilities during multi-sensory storytelling: A time sequential analysis.

4.1 Introduction

Multi-sensory storytelling (MSST) is a storytelling activity developed especially for people with profound intellectual and multiple disabilities (PIMD). The verbal content of these books is supported by stimuli for several senses. The content and form are fully adjusted to the preferences and abilities of a specific individual (Lambe & Hogg, 2011). Reading MSST books can have any of several aims, depending on the situation and the abilities of the listener. The aims of this intervention vary from including the listener in the culture of literacy and encouraging enjoyment of the storytelling activity (Fornefeld, 2013; Penne et al., 2012) to stimulating recognition and possible anticipation in the story (Ten Brug, Van der Putten, Penne, Maes, & Vlaskamp, accepted) and using the story to prepare for real-life events (Young et al., 2011).

To evaluate these aims, attention (Ten Brug et al., accepted) and engagement (Penne et al., 2012; Young et al., 2011) have been studied as outcome measures. Attention and engagement can be observed in behaviours that are related to the environment: attention is related to behaviour observed in interaction with a person or an object, and engagement is related to reactions to the environment. Researchers have proposed that there are optimal levels of both attention and engagement for learning and development (Munde et al., 2009). One related concept is alertness, which has been described as an inner state of mind, as well as in terms of behaviour related to the environment, thus overlapping with both attention and engagement. Alertness is broadly recognized as an important precondition for learning and development (Guess, Roberts, & Guy, 1999). Alertness during storytelling sessions is thus

important for the listener. The aims of MSST can be achieved only when the listener is alert.

Alertness can be divided into different levels, such that it can also describe behaviour that is sub-optimal for learning and development (Munde et al., 2009). Three general alertness levels have been distinguished (Green et al., 1994; Guess et al., 1999; Mudford, Hogg, & Roberts, 1997; Munde, Vlaskamp, Ruijssenaars, & Nakken, 2011). The first involves being alert and focused on the environment, with a distinction between active alertness (e.g., touching or moving along with music) and passive alertness (e.g., listening or sniffing). The second level refers to withdrawn behaviour, in which listeners are not engaged with objects or individuals in their environments, although they might be focused on themselves. The third level of alertness is designated as "asleep or drowsy." The three levels described here do not cover agitated and/or discontented behaviour, which is commonly distinguished as an additional or fourth level (Guess et al., 1999).

Repetition of a story and the active involvement of the listener are characteristics of MSST. The alertness of listeners can be enhanced by several factors, including the way in which stimuli are presented (Ten Brug et al., accepted; Young et al., 2011). Stimuli should therefore be presented in ways that allow manipulation by the listener. In addition to the manner in which stimuli are presented, another important factor involves the amount of time that the listener receives to react to the stimulus. Given the brief duration and rapid shifting of the alert moments of people with PIMD, it is important to avoid removing stimuli before the listener has had sufficient time to explore them (Guess &

Others, 1995; Mudford et al., 1997). Repeating the story multiple times in the same way provides listeners with more opportunities to recognize their personal books (Young et al., 2011) and perhaps to anticipate the stimuli that are presented.

Although information is available about the overall level of engagement and attention during storytelling, as well as about its general relationship with repetition and the presentation of stimuli when a story is repeated, the literature contains no information on the course of listener alertness during storytelling. We do not know if alertness increases during or after the presentation of stimuli, nor do we know whether it matters if a stimulus is presented actively or passively, or whether a story is read for the first or tenth time. Ten Brug and colleagues (accepted) report a positive relationship between the overall level of attentiveness and the number of actively presented stimuli, but researchers have yet to examine the amount of time that the storytellers allow their listeners or whether this is related to the alertness of the listener. This type of knowledge is important, as we know that listener alertness can vary over time (V. Munde et al., 2012) and that storytellers should be aware of the relationship between the way they present stimuli and the alertness of their listeners. If the manner of storytelling affects listener alertness, storytellers can adjust their storytelling habits in order to increase the alertness of their listeners. When listeners are alert, they have the opportunity to enjoy, become familiar with, and possibly learn to recognize their own personal stories.

This study focuses on the alertness of listeners during the presentation of stimuli while reading MSST books. To this end, we

analyzed the relationship between the active or passive presentation of stimuli by the direct support person (DSP) and the alertness of the person with PIMD. By comparing four storytelling sessions over time, we examined whether the relationship between the manner of presenting stimuli and the level of alertness changed when the story was repeated. We formulated the following research questions:

(1) What is the course of alertness during MSST sessions?
(2) To what extent is the course of alertness related to the presentation of stimuli?
(3) To what extent does this relationship vary across consecutive sessions?

4.2 Method

4.2.1 Participants

The participants in this study consisted of 27 dyads of a DSP and a person with PIMD. The DSP were recruited from 14 different organizations at 18 different locations in the Netherlands. The average age of the DSP (all of whom were women) was 38.4 years old (SD = 12.3). They had an average 11.7 years of experience working with people with PIMD (SD = 8.8). The majority (n = 13, 48.5%) had completed secondary vocational education, while the remaining nine (33.3%) held Bachelor's degrees. The educational level of five DSP (18.5%) was unknown. The DSP worked at least two days per week at the location where the study took place. Each DSP selected a person with PIMD to join the storytelling project.

The persons with PIMD were chosen by the DSP and were selected based on the characteristics of persons with PIMD, the definition of persons with PIMD as described by Nakken and Vlaskamp (2007) was used. This description was as follows: persons with PIMD are diagnosed with a developmental age under 24 months and had profound or severe motor disabilities. These people need support in all aspects of daily life, they are often bound to their wheelchair and have problems with both gross as fine motor skills. Their communication is mostly nonverbal and they have little use of symbolic communication (Nakken & Vlaskamp, 2007; Zijlstra & Vlaskamp, 2005). Also, there is a high prevalence of sensory impairments (25 - 85%, Evenhuis et al., 2001; van Gelderen in Zijlstra & Vlaskamp, 2005) (Evenhuis et al., 2001; Zijlstra & Vlaskamp, 2005) and general health problems like reflux and epilepsy (50% - 70%, Hogg, 1992; Böhmer et al. 1999) (Böhmer et al., 1999; J. Hogg, 1992). The group of people with PIMD consisted of 12 children and 15 adults, with a sex distribution of 13 male and 14 female.

4.2.2 Instruments

The listeners' level of alertness during storytelling sessions was observed, using the coding schedule from the Alertness Observation List (Vlaskamp, Fonteine, & Tadema, 2005). This list distinguishes four levels or types of alertness:

(1) *Actively and passively alert and focused on the environment*: The listener is engaged in an activity and focused on the environment. A distinction is made between active alertness (e.g., touching or moving along with music) and passive alertness (e.g., listening or sniffing).

(2) *Withdrawn behaviour*: The listener is not engaged with objects or individuals in his/her environment, but might be focused on him/herself, or might not have any focus at all. Stereotypical behaviour can also be placed within this category.
(3) *Asleep or drowsy*: The listener is sleeping, and moves accordingly or does not move.
(4) *Agitated and/or discontented behaviour*: The listener expresses feelings of discomfort (e.g., crying, shouting, screaming, self-injurious and destructive behaviour).

In order to gain a better view of how listeners demonstrate alertness, the DSP were asked to make individual profiles for each person with PIMD, describing the listeners' behaviour when engaged in an activity. In a previous study, the inter-observer and intra-observer reliability of the AOL was measured by comparing the observations of teachers with those of two external observers, one of whom was unfamiliar with the person with PIMD. The AOL was found to be reliable for determining alertness, with an average inter-observer reliability agreement of 81.46% and with inter-observer reliability agreement of 85.23% (Munde et al., 2011)..

4.2.3 Intervention

An MSST book is a short story supported by multiple sensory stimuli (Fuller, 1990; Lambe & Hogg, 2011; Ten Brug et al., 2012). The subject, text, and stimuli are fully attuned to the person's preferences and abilities, but also general guidelines exist in order to optimize listeners' alertness. MSST stories consist of 6 to 16 (short) sentences; these

sentences are supported by 6 to 8 stimuli. Each stimulus is linked to one or two sentences.

A book has a starting instruction. This instruction contains information about the ideal storytelling setting (e.g. the level of environmental noise, size of the room), about the best way of storytelling (e.g. tone of voice, distance to the listener) and on listeners characteristics (e.g. their ideal posture and the time they need to focus). The starting instruction is used by the storyteller. The stimuli used in the story are attached with elastic or Velcro to large neutral boards, which are used to make the stimuli more visible. After an initial presentation, the stimuli can be removed from these boards, and the listener should get the opportunity to manipulate the stimuli by him/herself. MSST books should be read multiple times in exactly the same way (Ten Brug et al., accepted).

The storytellers filled in a questionnaire (Inventory for tuning activities and situations to the abilities and preferences of children with profound intellectual and multiple disabilities (IPP)) (Tadema et al., 2005) concerning the preferences and abilities of the persons with PIMD during activities, and used this questionnaire in order to select the stimuli and write the starting instruction.

4.2.4 Procedure

The DSP included in this study either volunteered to participate (n = 11) or were approached by their supervisors and asked to participate (n = 16). Before the study, each DSP participated in a six-hour workshop, during which the theoretical background of MSST was described and the

MSST guidelines were introduced (along with the rationale behind them). After this theoretical introduction, the MSST books were written by the DSP and largely assembled at the workshop. All MSST books were reviewed by the researchers and corrected if necessary. Final modifications (e.g., minor changes in the text or replacing one stimulus) were made by the DSP at home.

The DSP identified a good period to start reading the MSST book, taking into account the personal schedule of the person with PIMD.

4.2.5 Analysis: coding schedule

The book was read twice a week for a period of 10 weeks, which amounts to 20 reading sessions. A researcher recorded the 1st, 5th, 10th, and 20th reading sessions. The number of recordings per session differed, partly because some recording sessions were cancelled due to holidays (n = 3), because the person with PIMD did not enjoy storytelling (one person, two recordings) or because of illness (n = 4) or death (n = 1) of the person with PIMD. In addition, we were not able to use some of the recordings (n = 9) because they could not be loaded into the video-annotation program ANVIL (Kipp, 2000). The number of recordings included for each storytelling session is specified in Table 1.

First, the duration of each session was determined. The session started when the first word of the story was spoken or a maximum of 10 seconds before the first stimulus was presented. The session stopped 10 seconds after the last words of the story were spoken or 10 seconds after the last stimulus was put away.

Table 1
Number of recordings included and excluded per session.

		Session			
		1	5	10	20
Included		21	24	23	22
Excluded	Unable to load into the video-annotation program	6	1	2	-
	Holidays	-	-	-	3
	Sickness or death	-	3	1	1
	Appeared to dislike story	-	-	1	1

All available videos were scored continuously according to three variables:

(1) *Alertness*: Alertness was scored in segments. A segment starts when the type of alert behaviour occurs and ends when another state of alertness begins. Segments were not allowed to overlap. During each segment, the listeners' state of alertness (active alert, passive alert, withdrawn, asleep, or agitated) was scored.

(2) *Presentation of the stimulus*: Stimuli were also scored using segments, starting from the moment a stimulus was introduced and ending when it was put away. When a stimulus was used by the DSP and/or the listener, it was scored as "presented." It was then scored according to whether it was presented (1) actively or (2) passively. A stimulus is presented "actively" if the listener has the opportunity to manipulate the stimulus, with or without help of the storyteller. Stimuli presented in a partially active manner (e.g., the DSP starts a song by pushing a button, after which the listener is given the opportunity to push the same button) were also scored as active. A stimulus is presented in a "passive" manner if the listener has no input about what happens with it.

We calculated the rate of inter-observer reliability for the observation of alertness and the presentation of stimuli. In all, 16 (18%) recordings of different storytelling dyads were observed by two researchers and scored on the two variables. For listener alertness, the percentage of time in the alert state (as agreed by the two researchers) was calculated (Mudford et al., 1997); the researchers agreed in 59.0% of the cases. Variations for individual observations ranged from 18.5% to 84.5%, with the lowest value being an outlier. The elimination of this outlier increases the average inter-observer reliability rate to 61.7%.

Two percentages were calculated for the rate of inter-observer reliability regarding the presentation of stimuli. First, the segmentation agreement (the percentage of agreement between both observers about whether a stimulus was presented) was calculated. Segmentation agreement for the presentation of stimuli was 85.9% (range: 72.59%–97.08%). Second, the overall coding agreement was calculated, taking into account agreement on segments and considering the categories (active presentation versus passive presentation). The average overall coding agreement for the presentation of stimuli was 77.4% (range: 59.59% – 96.33%).

4.2.6 Analysis: data analysis

For each measurement, the relative frequency and average duration of the different stages of alertness were determined. The average duration of the presentation of stimuli was calculated. In order to provide a complete view of the storytelling sessions, the average duration of the time in which no stimulus was presented was also calculated, and the level of alertness during those moments was scored.

Time-sequential analysis was used to reveal information about the sequences of events during an MSST reading session. As the independent variable, the presentation of the stimulus was divided into two categories: (1) passive stimulus or (2) active stimulus. The target (i.e., dependent variable) was the alertness of the listener.

Three time windows of equal length were defined with regard to the presentation of the stimuli. The time windows were adjusted to the average length of the presentation of stimuli and the average gap between two stimuli. For each time window, the observed proportion was calculated for the three levels of alertness. The first window includes the first 10 seconds of the stimulus presentation. The second time window covers the last 10 seconds of the presentation of the stimulus, and the third and last window consists of the 10 seconds directly following the presentation of the stimulus. Because no "asleep" behaviour was observed and "agitated" behaviour was very rare (40 of the 20028 observed seconds), these alertness levels were excluded from the time-sequential analysis.

Yule's Q was calculated in order to clarify the difference between the expected and the observed alertness. Values can vary from -1 to 1, with negative values implying a lower observed count relative to the expected count and positive values indicating that the observed count is higher than expected. Values that are closer to the extremes of 1 or -1 indicate greater differences between the observed and expected count, thus indicating a clearer relationship (in this case, between the alertness of the listener and the two independent variables). When there is no significant difference between the observed and expected count, the Yule's Q value

is 0 (Bakeman & Gottman, 1997). All Yule's Q values are reported, but only those that are more extreme than -.20 and .20 are discussed in the results section. Values between -.20 and .20 are close to zero, thus representing only minor deviations from the expected values.

In order to determine whether the relationship between the presentation of stimuli and the course of alertness differs when books are read more frequently, we compared the results of the four measurements. We summarized the analyses described above for the four sessions, and compared them to each other, in addition to describing changes in outcomes between the four consecutive sessions.

4.3 Results

4.3.1 Course of alertness

In the 21 video recordings of the first session, alertness was measured during 4886 seconds (81.4 minutes). In all, 314 moments of alertness can be distinguished. The total duration of reading sessions was shortest for the 20th session (4022 seconds [67.0 minutes]) and longest for the 10th session (5669 seconds [94.5 minutes]). Passive alertness was most common in terms of both duration (44% –53% of the total duration) and number of moments (43%–45% of the total number of periods) (see Table 2).

We were unable to score alertness in 4% to 7% of the duration of the recordings, due to the poor quality of the recordings (e.g., backlight) or because the listener turned away, making it impossible to observe

Table 2
Description of the alertness people during the four sessions

	Session 1 (n = 21)						
	A	P	W	S	D	U	T
Frequency	66	137	98	-	1	13	315
%	21	43	31	-	0	4	
Duration (in sec.)	1241	2329	1096	-	15	205	4886
%	25	48	22	-	0	4	
Average duration (in sec.)	18.8	17.0	11.2	-	15.0	15.8	15.5
	Session 5 (n = 23)						
	A	P	W	S	D	U	T
Frequency	81	166	118	-	-	16	381
%	21	44	31	-	-	3	
Duration (in sec.)	1441	2387	1498	-	-	125	5451
%	26	44	27	-	-	2	
Average duration (in sec.)	17.8	14.4	12.7	-	-	7.8	14.3
	Session 10 (n = 23)						
	A	P	W	S	D	U	T
Frequency	77	162	119	-	1	10	369
%	21	44	32	-	0	3	
Duration (in sec.)	1090	2892	1451	-	23	213	5669
%	19	51	26	-	0	4	
Average duration (in sec.)	14.2	17.9	12/2	-	23.0	21.3	15.4
	Session 20 (n = 20)						
	A	P	W	S	D	U	T
77	152	92	-	1	18	340	
23	45	27	-	0	5		
883	2142	709	-	2	286	4022	
22	53	18	-	0	7		
11.5	14.1	7.7	-	2	15.9	11.8	

A = active alert
P= passive alert
W = withdrawn behaviour
S = asleep or drowsy
D = agitated and/or discontented
U = unknown
T = total

alertness. In all four sessions, the frequency of withdrawn behaviour exceeded that of active alertness (27%–32% of the total moments, as compared to 21%–23% for active alertness). The relative duration of active alertness was higher during the 1st and 20th sessions, however, in which the average duration of periods of active alertness exceeded that of periods of withdrawn behaviour. "Agitated" behaviour occurred only

once during the 1st, 10th and 20th sessions (2–23 seconds), and "asleep" behaviour did not occur during any of the sessions.

4.3.2 Presentation of stimuli

Table 3 provides a description of the presentation of the stimuli during the sessions. The average number of stimuli presented during the storytelling sessions ranged from 6.4 to 7.1. Most of the stimuli (50%–64%) were offered passively (see Table 3). The average duration of offering a stimulus passively was lowest during the 20th session (17.44 seconds) and highest during the 10th session (20.72). The active presentation of stimuli took longer (26.44–32.40 seconds). The average duration of periods in which no stimuli were presented ranged from 6.7 seconds (during the 20th session) to 9.8 seconds (during the 1st and 10th sessions).

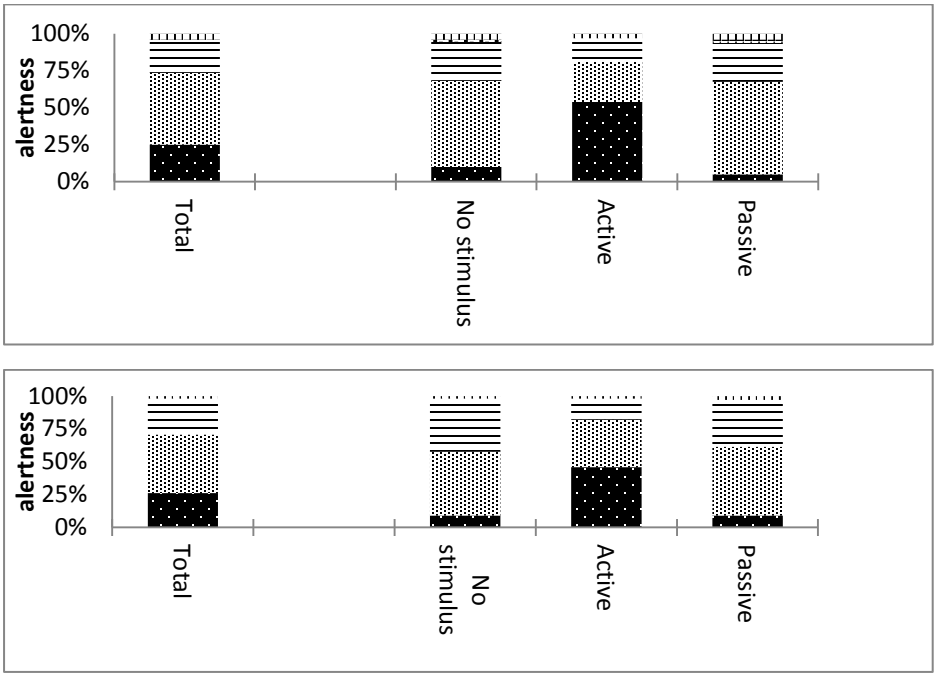
Table 3

Description of the presentation of stimuli during multi-sensory storytelling

Session	Stimuli presented	Freq. (%)	Duration (seconds)
1	Active	58 (43)	32.40
	Passive	76 (57)	20.32
	total	134	25.54
5	Active	82 (50)	31.08
	Passive	81 (50)	18.54
	total	163	22.14
10	Active	61 (41)	26.44
	Passive	89 (59)	20.72
	total	150	23.05
20	Active	49 (36)	29.49
	Passive	89 (64)	17.44
	total	138	21.72

For all four storytelling sessions, more alertness was observed during the active presentation of stimuli than was observed during the passive

presentation of stimuli (54%, 46%, 44%, 45% versus 5%, 9%, 9%, 7%, respectively). Withdrawn behaviour was more prevalent when stimuli were offered passively (23%–35%) as compared to when they were offered actively (16%–7%). When no stimulus was offered, active alertness was observed for 9%–12% of the time, with passive alertness observed for 47%–59% of the time and withdrawn behaviour for 24%–40% of the time (see Figure 1).



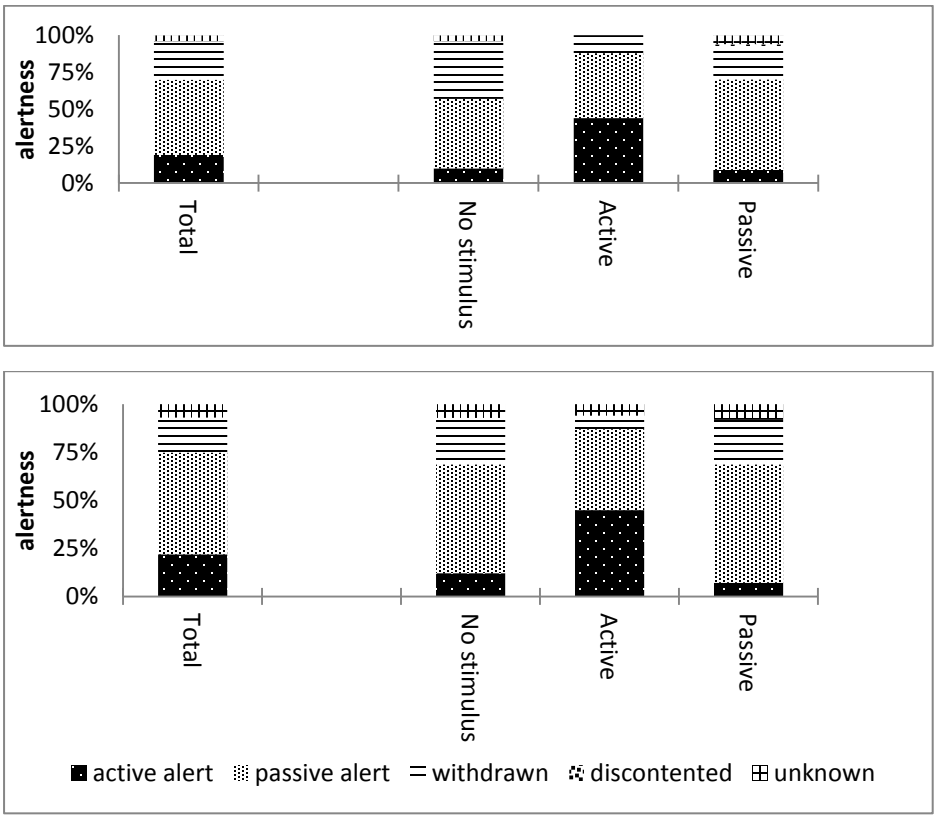
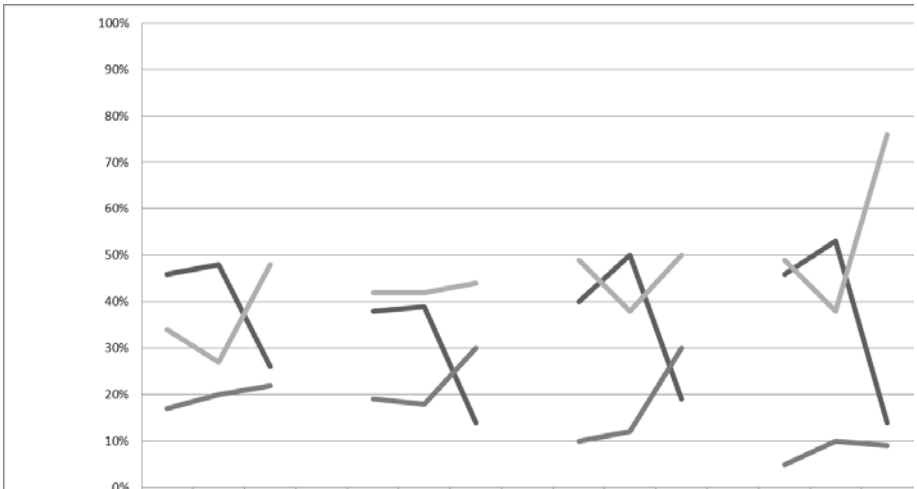


Figure 1. Alertness during the presentation of stimuli in the 1st, 5th, 10th, and 20th storytelling sessions

Figure 2 shows the development of alertness after the stimuli were presented actively. On average, during the first time window (i.e., the first 10 seconds of the presentation of a stimulus) of the first storytelling session, the listener exhibited active alertness for 46 % of the time. During the two subsequent time windows, the percentage of active alertness increased by 2%, thereafter decreasing to 26% during the final window (10 seconds after the stimulus was presented). During the consecutive storytelling sessions (5, 10, and 20), passive alertness was more prevalent during the first time window, but active alertness

increased by 1%, 10%, and 7% from the first to the second window, such that active alertness was more prevalent in the second window of the 10th and 20th sessions.



	Start	End	After	Start	End	After	Start	End	After	Start	End	After
active alert	0,46	0,48	0,26	0,38	0,39	0,14	0,4	0,5	0,19	0,46	0,53	0,14
passive alert	0,34	0,27	0,48	0,42	0,42	0,44	0,49	0,38	0,5	0,49	0,38	0,76
withdrawn	0,17	0,2	0,22	0,19	0,18	0,3	0,1	0,12	0,3	0,05	0,1	0,09

Figure 2. Average proportion of alertness during the six sequential time windows after the active presentation of a stimulus. Outcomes for the four consecutive sessions.

During all four measurements, withdrawn behaviour increased from the first to the last time window, accounting for at least 4% of the time (during the 20th storytelling session) to as much as 20% (during the 10th session) (see Figure 2). The Yule's Q values for the presentation of stimuli are displayed in Table 4, with values more extreme than -.20 and .20 printed in bold.

During the first two time windows of actively presented stimuli, active alertness occurred more often than expected (Yule's Q: .49 and .51). Withdrawn behaviour occurred less often during the first two time

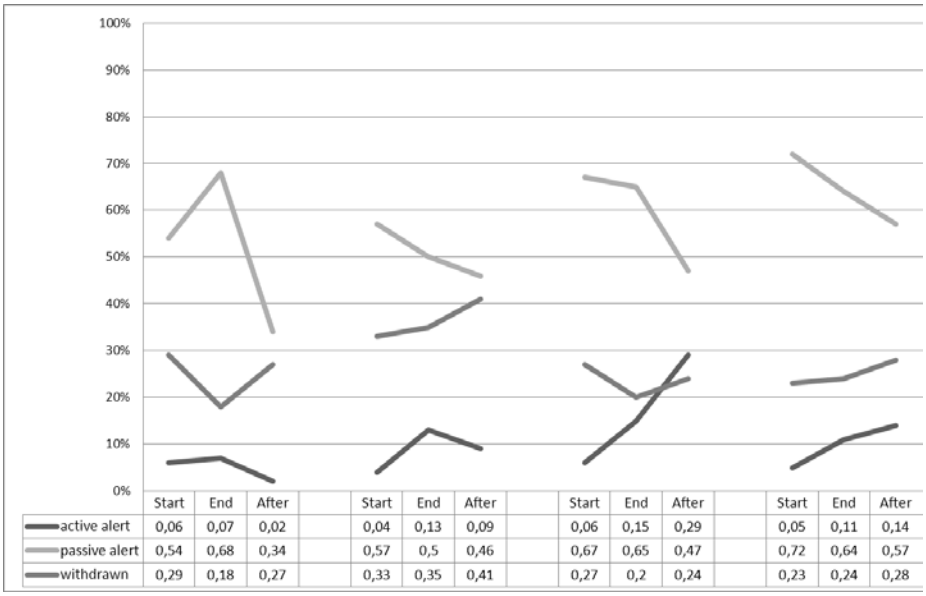
Table 4

Yule's Q values for the three time windows around the presentation of stimuli.

			Time windows		
Session			Start	End	After
1	Active	active alert	.49	.51	.03
		passive alert	-.31	-.45	.01
		withdrawn	-.19	-.09	-.02
	Passive	active alert	-.72	-.66	-.89
		passive alert	.14	.43	.35
		withdrawn	.20	-.15	.15
5	Active	active alert	.31	.32	-.41
		passive alert	-.05	-.05	.15
		withdrawn	-.26	-.31	.17
	Passive	active alert	-.80	-.45	-.58
		passive alert	.29	.15	.06
		withdrawn	.15	.20	.33
10	Active	active alert	.53	.65	-.03
		passive alert	-.09	-.33	-.06
		withdrawn	-.56	-.48	.10
	Passive	active alert	-.62	-.19	.26
		passive alert	.31	.26	-.14
		withdrawn	.01	-.20	-.06
20	Active	active alert	.53	.62	-.32
		passive alert	-.20	-.41	.44
		withdrawn	-.65	-.41	-.41
	Passive	active alert	-.76	-.46	-.32
		passive alert	.37	.17	-.01
		withdrawn	.17	.18	.29

Values more extreme than -.20 or .20 are printed in bold.

windows of the 5th, 10th, and 20th storytelling sessions (see Table 4). After the passive presentation of a stimulus, passive alertness was observed in all three time windows of all four measurements (see Figure 3). Active alertness was least prevalent in each time window, except for the third window of the 10th session, varying between 2% and 29%. Withdrawn behaviour was observed for between 23% and 33% of the time during the first time window in all four measurements, with the highest amount of withdrawn behaviour (41%) observed during the third window of the 5th session.



	Start	End	After	Start	End	After	Start	End	After	Start	End	After
active alert	0,06	0,07	0,02	0,04	0,13	0,09	0,06	0,15	0,29	0,05	0,11	0,14
passive alert	0,54	0,68	0,34	0,57	0,5	0,46	0,67	0,65	0,47	0,72	0,64	0,57
withdrawn	0,29	0,18	0,27	0,33	0,35	0,41	0,27	0,2	0,24	0,23	0,24	0,28

Figure 3. Average proportion of alertness during the six sequential time windows after the passive presentation of a stimulus. Outcomes of the four sessions.

During the 1st, 5th, and 20th sessions, active alertness occurred less often than expected in all three time windows (see Table 4). When withdrawn behaviour and passive alertness deviated from the expected level, they occurred more often.

4.4 Conclusions

This study focuses on the course of alertness during storytelling, and specifically analyzing the relationship between the manner in which stimuli are presented and alertness, in addition to examining whether this relation changes when a story is read repeatedly over time. The listeners were usually passively alert during the four measurements. Moments during which the listeners exhibited withdrawn behaviour

were shorter, as compared to passive or active alert moments. Active alertness seems to be related to the manner in which stimuli were presented. Active alertness was observed more during the active presentation of a stimulus (with averages per measurement varying between 44% and 54%) than was observed compared to when stimuli were presented in a passive way, or when no stimuli were presented at all (averages between 5% and 12%). Moreover, the active presentation of stimuli was associated with larger contrasts between time windows with regard to alertness levels. Changes between time windows were more gradual when stimuli were presented passively.

The time-window sequential analysis revealed several patterns in the course of alertness. For stimuli presented in an active way, more alertness was observed in the last 10 seconds of the presentation, as compared to the first 10 seconds. Active alertness was less common during the 10 seconds after a stimulus was presented. When stimuli were presented in a passive manner, passive alertness was the most commonly observed behaviour in all time windows, varying between 72% and 34%. Active alertness varied between 2% and 29%, increasing between the first and third time windows in all but the first storytelling session.

4.5 Discussion

In this study, inter-observer reliability for alertness observations ranged from 18.5% to 84.5%. The variation in reliability was nevertheless consistent with other studies in which the behaviour of people with PIMD has been observed (Mudford et al., 1997; Vlaskamp & Cuppen-Fonteine, 2007). In order to increase reliability when observing the listeners' alertness, the researchers used the profiles that

had been prepared by the storytellers. For some participants, inter-observer reliability was low (< 55%). Close examination of these videos reveals that the recording of one person was difficult to score due to backlight. In three other videos, the profound motor disabilities and severe spasms of the individuals with PIMD made it extremely difficult to observe their behaviour (inter-observer reliability 38.2%, 43.16%, and 51.4%). Another person (46.6% agreement) frequently looked upwards and stretched his arms. The first observer interpreted this behaviour as "withdrawn behaviour," while the second observer marked the same behaviour as "actively alert." Other studies have also reported difficulties in obtaining high inter-observer reliability when measuring behaviour states (Mudford, Hogg, & Roberts, 1999), as well as problems related to observing the alertness of individuals with PIMD, due to uncontrolled movements (Munde et al., 2011). One suggestion for future studies might be to allow the storytellers to report their own interpretations of the behaviour of listeners.

Another point arises with regard to group composition. More specifically, each measurement involved different groups. Although 27 dyads participated in this study, complete data (i.e., all four measurements) are available and useable for only nine dyads. For three dyads, two recordings could be used, while three recordings were available for the other dyads. Missing data constitute a typical pitfall for practice-oriented research. There were various reasons for the loss of data (e.g., illness on the part of the listener, or the inability to load a specific video format into the annotation program), and they do not seem to be related to the content of this study. A final limitation concerns the characteristics of the people with PIMD. Persons with PIMD often have

(multiple) sensory impairments (Evenhuis et al., 2001) and health related problems like epilepsy for which medication is prescribed (J. Hogg, 1992; Zijlstra & Vlaskamp, 2005). Sensory impairments and health problems were not included as an intervening variables in this study. Sensory impairments limit the possibilities for the storyteller but also the ability of the person with PIMD to show attentive reactions. Medication used to treat health problems can have a negative impact on the alertness of a person with PIMD (Zijlstra & Vlaskamp, 2005). However, because the individualized character of MSST books, the books were fitted to the listeners' abilities and known sensory impairments and health problems were accounted for. Further research could focus on the relation between client characteristics the effectiveness of MSST.

Consistent with previous studies on the attention of listeners (Ten Brug et al., accepted), we observed a high percentage of listener alertness during the MSST sessions. Alertness was not constant within storytelling sessions, however, and the changes appeared to be related to the way in which the stimuli were presented. In our observations, active alertness, passive alertness, and withdrawn behaviour appeared to alternate. This result corresponds to the "waves" reported by Munde and colleagues (2012), who argue that people with PIMD need such waves in order to process information, and that the waves vary according to different types of stimuli.

The results of this study provide useful suggestions for how storytellers might be able to increase the alertness of their listeners. First, several striking features about the structure of the story emerged in this study. For example, the results indicated that the periods in which

stimuli were offered passively were relatively short (averaging between 17.4 and 20.7 seconds). It could be that the presentations were too brief, giving the people with PIMD no time to react to the stimuli (Guess et al., 1999; Mudford et al., 1997; Munde, Vlaskamp, Maes, & Ruijssenaars, 2012). The variation in alertness levels during the time windows raises questions as well. The listeners exhibited the most alert behaviour during the last 10 seconds of the active presentation of stimuli. It would be interesting to investigate what would happen if the stimuli were to be presented for a longer period.

Another question concerns the gap between stimuli. In our study, the average gap varied from 6.7 to 9.8 seconds. It could be that the listeners did not have enough time to process the prior stimulus and focus on the new one. For example, in one study, Munde and colleagues (2012) report that when stimuli were presented for longer periods, listeners became actively alert during the first 10 seconds, shifting to withdrawn behaviour after 20 seconds, and returning to an actively alert stage at 60 seconds. Storytellers could apply this knowledge to MSST and increase the length of their presentations of stimuli. They should also be aware of their storytelling speed, possibly adjusting it to their listeners' ability to react to stimuli.

Rather than being a passive experience, MSST is intended to be an activity in which a listener can participate actively. Previous studies have shown that the inclusion of more active stimuli in an MSST book increased the overall attention of listeners to the activity (Ten Brug et al., accepted). In the current study, which focuses on the distribution of alertness during the passive and active presentation of stimuli, active

alertness was most commonly observed when stimuli were presented in an active way (e.g, when the listeners had the opportunity to manipulate the stimuli themselves). Nevertheless, most stimuli were offered passively, although many could be adjusted to make them actively accessible to the listener. For example, an auditory stimulus could be presented using a large red button that the listener could push (with help of the storyteller) to activate it.

In this study, the storytellers' behaviour changed as the book was read more often. During the first storytelling session, the presentation of a stimulus lasted an average of 25.5 seconds, as compared to 21.7 seconds during the last session. These changes are likely to have affected the alertness of the listeners. Although listeners exhibit more active alertness during the presentation of active stimuli, this alertness generally disappears as soon as the stimulus is removed.

The results of our study suggest that storytellers should be aware of the relationship between their storytelling behaviour and the alertness of their listeners. By looking at their own behaviour closely over time, they could learn to adapt their storytelling to the needs of their listeners at different points in the story, thus having a positive effect on the alertness of their listeners.