Joint attention behaviours in people with profound intellectual and multiple disabilities: the influence of the context

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Background In spite of the profound cognitive and physical problems, people with profound intellectual and multiple disabilities (PIMD) are able to develop joint attention behaviours (JAB) and benefit from positive interactions.
Aims To investigate which context factors influence the JAB of people with PIMD.
Method Based on video recordings of 45 participants, JAB and context factors were analysed.
Results An unstructured interaction situation produced the most responses of a person with PIMD, whereas a structured interaction situation produced the most initiatives. Furthermore, the familiarity of the partner and the familiarity of objects used in the interaction had no influence on the JAB. The sensitivity of the interaction partner was positively related to the presence of JAB.
Conclusions Interaction partners of people with PIMD should be aware of both the ability of people with PIMD to use JAB and the influence of different context factors on these JAB.

Keywords: adults, context, joint attention behaviours, profound intellectual and multiple disabilities

Introduction

Quality of life is a central construct in research about persons with profound intellectual and multiple disabilities (PIMD). Due to a combination of profound intellectual and serious motor and/or sensory disabilities, they are almost totally dependent on other people to attain an optimal quality of life (Nakken & Vlaskamp 2007; Petry *et al.* 2007). In this respect, different studies found that developing communication partnerships is crucial for the quality of life of persons with PIMD (e.g. Wilder & Granlund 2003; Petry *et al.* 2005). However, because of their complex needs, it is challenging to develop these high-quality interactions and communicative partnerships with them.

A review of the research (Hostyn & Maes 2009) has found joint attention to be a core component to constitute the interaction process with persons with PIMD. This component is considered by the authors to be a dyadic variable which is formed through the contribution of both interaction partners and the harmonization among their behaviours, which determines the quality and successfulness of the interaction. In this respect, the question arises of how to support the behaviours [joint attention behaviours (JAB)] necessary to create joint attention episodes in an interaction with persons with PIMD might be supported. More specifically, there is a considerable need for more knowledge about the nature of JAB used by persons with PIMD and about the factors that promote or hinder them in showing JAB.

Many studies can be found on the development of JAB in the general population (e.g. Trevarthen 1979; Adamson & Chance 1998; Carpenter *et al.* 1998; Mundy *et al.* 2007; Gredebäck *et al.* 2010). In general, the transactional developmental model is often used to describe outcomes in different developmental domains (e.g. cognitive development and communicative development). In this approach, these developmental

outcomes are a result of continuous transactions between the person and his context (e.g. Sameroff & Fiese 2000; Sameroff & MacKenzie 2003; Naoi *et al.* 2008). When we look at JAB from this transactional framework, individual differences in the JAB of persons with PIMD may be expected to be determined by personal characteristics as well as by contextual factors.

Mundy *et al.* (2007) describe the multiple process model (MPM) of joint attention, which looks at the JAB necessary to create joint attention episodes in an interaction. The function of these behaviours is to coordinate attention between interactive social partners with respect to objects or events, or to share an awareness of the objects or events (Dawson *et al.* 2002). The model distinguishes between two types of JAB: initiating joint attention behaviours (IJAB) and responding to joint attention behaviours (RJAB). The IJAB are behaviours used to direct the attention of the other person to objects or events in the environment. These behaviours refer to the occurrence of eye contact, alternating eye contact, pointing to, or showing an object, to initiate joint attention to an object (Mundy *et al.* 2003). RJAB are behaviours used to follow the direction of the gaze and gestures of others in order to share a common point of reference (Mundy *et al.* 2007; Mundy & Jarrold 2010). These behaviours refer to the person's skill in following the interaction partner's gestures and line of regard.

To date, our knowledge about JAB used by persons with PIMD in interactions remains limited and incomplete. Of the studies that investigate JA, most give a global rating of JA without looking at the specific JAB (e.g. Olsson 2004; Hostyn *et al.* 2011), while looking at specific behaviours is important to identify often-used JAB that deserve special attention from the interaction partner. To our knowledge, there are only three studies that looked at specific JAB in persons with PIMD. First, Olswang *et al.* (2013) found that babies with severe disabilities could perform triadic gaze. A triadic gaze can be described as the back and forth, coordinated shift in gaze between an object and a partner (Dunst & Lowe 1986). Second, Neerinckx *et al.* (2013) investigated more diverse IJAB. They found that persons with PIMD mostly used eye contact or gaze shifts to attract or to direct the attention of their interaction partner. Previous work from this group has shown that JAB develop in the same order as in typically developing children. However, the occurrence of some specific JAB is positively or negatively influenced by personal characteristics, such as motor problems in the upper limbs, sensory problems and temperament.

To our knowledge, there is no research about the influence of contextual factors on JAB of persons with PIMD. Additionally, most of the work on JAB has been conducted with children. Therefore, the aim of the present study complements the existing knowledge by investigating several context factors contributing to individual differences in JAB in adults with PIMD. In order to enhance the opportunities for adults with PIMD to display JAB, it is necessary to acquire more insight in these contextual factors. Contextual factors that have been described in the literature as having a possible influence on children's JAB are (i) the interaction situation, (ii) the interaction partner and (iii) the objects used in the interaction.

The interaction situation

Kasari *et al.* (2005) demonstrated that a strongly structured interaction situation elicited more JAB than a situation of free play. Whalen & Schreibman (2003) also found that children with an autism spectrum disorder (ASD) showed more JAB in a strongly structured situation than in an unstructured interaction. Based on these results, we expected that the use of JAB will be higher in a situation which is specifically structured and adapted to elicit JAB in persons with PIMD.

The interaction partner

First, the familiarity of the interaction partner can influence JAB. Several researchers found that both typically developing children and children with an autism spectrum disorder (ASD) show more JAB in an interaction with a non-familiar partner than in an interaction with a familiar interaction partner (e.g. Striano & Bertin 2005). Second, the sensitivity of the interaction partner has also been shown to be important. In typically developing children, positive correlations have been found between maternal sensitivity on the one hand and triadic interactions or JAB on the other hand (Hobson *et al.* 2004; Gaffan *et al.* 2010). Sensitivity, in this case, can be described as the extent to which the one partner seems to be aware of and understands the activity and play interests of the other (Mahoney 1992). Additionally, Bakeman & Adamson (1984) demonstrated that JAB occurred more frequently when engaging with a more capable social interaction partner (parent), while it was relatively rare when people were engaged with a less capable partner (peers). Based on these results, we

hypothesized that persons with PIMD will show more JAB in an interaction with a non-familiar partner who shows a high amount of sensitivity.

The objects used in the interaction

We expected that objects adapted to the individual interests and preferences of the person with PIMD will elicit more JAB. This hypothesis was based on the findings of comparable research in different target groups. Jones *et al.* (2006) demonstrated that objects that were capitalized on the interest of a child with ASD elicited more RJAB and IJAB than objects that were not consistent with each child's preferences. Also, experts in the functioning of persons with PIMD emphasize the importance of adapting stimuli to the individual differences in abilities, preferences and reactions of these persons to elicit more alertness and more active engagement, given the wide range of sensory and motor impairments in this group (Van Splunder *et al.* 2006; Munde *et al.* 2012a,b).

Method

Participants

The research group consisted of 45 adults with PIMD selected from nine residential support services for people with PIMD situated in Flanders. The services were randomly selected from the overall group of residential support services for people with PIMD. Direct support workers (DSWs) and client representatives were informed about the study, including a guarantee of anonymity and confidentiality in data treatment. Inclusion criteria for the participants were as follows: (i) having a profound intellectual disability [IQ < 20; mental age (MA) <24 months according to the Uzgiris-Hunt scales of sensorimotor development (Kerssies *et al.* 1989)], (ii) having a severe neuromotor disability, (iii) communicating at a non-symbolic level, (iv) being older than 18 years and (v) being in the service for more than 1 year. Written consent for participation in the study was obtained from the parent or legal guardian of the participant. We made the explicit choice to exclude totally blind and deaf people to avoid distortion of the results with regard to the use of several visual and auditory objects. However, we did not exclude people with visual or auditory impairments that frequently occur in the target group (Evenhuis *et al.* 2001; Van Splunder *et al.* 2006). As they clearly benefit from the adapted use of visual

and auditory stimuli (e.g. showing an object in their visual field or directing sounds to their better hearing side), these sensory cues can still be included. For each client, a member of the DSW team, who has worked with the client for at least 1 year, was included. This way, 45 unique dyads have been composed. Detailed participant characteristics can be found in Table 1.

Consent and ethics

This observation study was performed in accordance with the guidelines of the ethical committee of the authors' university (Commissie Medische Ethiek van de universitaire ziekenhuizen KU Leuven, reference number: S56136).

Measures

Object spectacle task/book presentation task/gaze following task (Early Social Communication Scale)

The Early Social Communication Scale (ESCS) is an instrument often used in research to assess the development of different dimensions of non-verbal communication (Mundy *et al.* 2003). Since we were interested in JAB of the persons with PIMD, we used three subtests of the ESCS. First, the Object Spectacle Task was used to measure the IJAB. During this task, the participant was presented with a series of three wind-up mechanical toys (tambourine, dancing penguin and musical puppet) and three hand-held mechanical

Table 1 Descriptive characteristics of the participants ($n = 45$)

Variable	Descriptives
Age	Range = 18–69 years ($\bar{x}$ = 39.5; SD = 14.4)
Developmental age	Range = 1–24 months ($\bar{x}$ = 13.7; SD = 8.8)
Gender	
Female	$n = 21$ (46%)
Male	$n = 24$ (53%)
Sensory impairments	
Visual impairments	$n = 25$ (55%)
Auditory impairments	$n = 20$ (44%)
Motor problems	
Upper limbs only	$n = 5$ (11%)
Lower limbs only	$n = 21$ (48%)
Upper and lower limbs	$n = 23$ (51%)
Epilepsy	$n = 27$ (59%)

toys (rain tube, pinwheel and balloon). In each presentation (three trials each), the partner activated the toy on the table in front of, but out of reach of the participant. The partner remained silent, but attentive to the participant while the toy is active to allow him/her to show IJAB. Second, the Book Presentation Task and the Gaze Following Task were used to investigate the RJAB of the person with PIMD. In the Book Presentation Task, a picture book was opened and presented on the table within the participant's reach. The partner allowed the participant to examine the book for approximately 20 s. After the 20-second interval, the partner started pointing to a picture on the left side of the book, while saying the participant's name. Then the partner pointed to a new picture on the right side of the book, without saying anything, to test whether the participant followed the pointing of his/her partner (RJAB). This procedure was repeated twice. In addition, the partner presented the person with PIMD with the Gaze Following Task. During this task, two sets of four gaze-following trials were presented. In these trials, the partner gained the participant's attention by empathically calling out his/her name three times, while turning towards, pointing to and remaining visually fixated on a poster located in the room. Left, left-behind, right and right-behind trials were presented.

Maternal Behaviour Rating Scale

The interaction partner's (DSW or researcher) sensitivity was measured by using the Maternal Behaviour Rating Scale (MBRS; Mahoney 1992). The MBRS was initially developed to evaluate the effects of early intervention programmes that promote the interaction between mothers and their children with severe disabilities (Mahoney *et al.* 1985). More recently, Hostyn *et al.* (2010)

have demonstrated that this scale is applicable to the interaction between persons with PIMD and their interaction partner.

Procedure

Information forms

Before the observations were conducted, two DSWs were asked to jointly fill in an information form consisting of an affective communication profile and a profile of engagement of the person with PIMD. These standardized profiles respectively provide information about the participant's characteristic utterances to show (dis-)satisfaction or (non-)well-being and (dis-)engagement with a person and with objects (Petry & Maes 2006). Utterances can be described on the following levels: gaze direction, facial expression, mouth activity, sounds, head position or movements, body position or movements, physiological reactions, and conventional gestures. These allowed the coder to be more sensitive in recognizing and interpreting the idiosyncratic and subtle utterances and signals of the client.

Design

The data collection procedure consisted of six conditions of about 10 min. Within these six conditions, two groups of three interactions can be distinguished: three interactions between a person with PIMD and a member of his/her DSW team (situations SP_DSW_S, SP_DSW_A and ST_DSW in Figure 1) and three interactions between a person with PIMD and the researcher (situations SP_R_S, SP_R_A and ST_R in Figure 1):
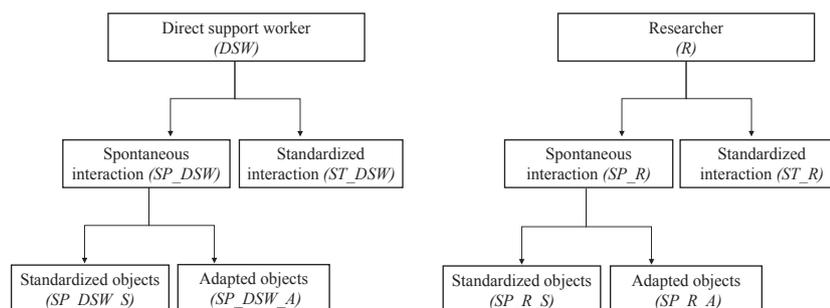

Figure 1 Design of the study.

1. **SP_DSW_S**: The DSW spontaneously interacted with the person with PIMD using six standardized objects (see § 2.3.1. for a description of the objects).
2. **SP_DSW_A**: The DSW spontaneously interacted with the person with PIMD using six individualized objects. These objects are personal objects from the person with PIMD, adapted to the individual interests and preferences, according to the DSW.
3. **ST_DSW**: The DSW interacted in a standardized way with the person with PIMD using six standardized objects (see § 2.3.1. for the instructions and a description of the objects).
4. **SP_R_S**: The researcher spontaneously interacted with the person with PIMD using six standardized objects (idem as in situation A11).
5. **SP_R_A**: The researcher spontaneously interacted with the person with PIMD using six individualized objects (idem as in situation A12).
6. **ST_R**: The researcher interacted in a standardized way with the person with PIMD using six standardized objects (idem as in situation A2).

Observations

The dyads were videotaped in a familiar setting, which is a silent room in the support service's premises. All observations were videotaped with two cameras, one providing an overview of the dyad in its context and the other zooming in on the person with PIMD to be able to register his/her subtle communicative signs. For every participant, the observations of the six situations were conducted within the same week. The different observations were rotated between the different participants.

Coding

A coding scheme (Table 2) was used to code the participant's RJAB and IJAB. Two codes were used to code the RJAB (following line of regard, following pointing). For the IJAB, five different codes were used. In addition to the four specific behaviours described in the Introduction (i.e. (alternating) eye contact, pointing to, and showing an object), we used a category other behaviour, which consists of person-related behaviours such as specific body movements and vocalizations which are used to direct or share the attention of the interaction partner. We defined two conditions required to code the specific behaviour as IJAB (Nowakowski *et al.* 2009; Tasker & Schmidt 2008), namely if the behaviour is active and intentional and if it is clearly

Table 2 Coding scheme for RJAB and IJAB of the participants

RJAB	
Following pointing	Person with PIMD orients head/body/eyes to the picture
Following line of regard	Person with PIMD orients head or eyes to the direction where the interaction partner is looking
IJAB	
(Alternating) eye contact	Person with PIMD makes eye contact with the interaction partner while manipulating or touching a toy
	Person with PIMD alternates a look between an object and the partner's eyes
Pointing	Person with PIMD points to a toy (may occur with or without eye contact)
Showing	Person with PIMD raises a toy upward towards the partner's face
Other behaviour	Person-related behaviours: specific body movements and vocalizations

directed to the partner. To identify the first criterion, the intentionality of a behaviour, we used the following behavioural indicators: (i) the goal directedness of the behaviour, which is determined by the persistence or the extended repetition of the behaviour until the goal is reached (e.g. Bruce & Vargas 2007; Vandereet *et al.* 2010), and (ii) the anticipation of a response and/or showing satisfaction or dissatisfaction with the response of the partner (e.g. Stephenson & Linfoot 1996). The second criterion, the directedness towards the partner, is determined by the person's bodily proximity, body or head orientation, or by turning their body between the partner and the goal (e.g. Iacono *et al.* 1998; Brady *et al.* 2012).

Six persons participated in the coding: the first author, one colleague researcher and four master students. Before coding the observations, the different observers were trained. This was done by explaining the underlying concepts and the theoretical background of the schemes. Then, the coding schemes were introduced and more information about the use of different codes was delivered. Lastly, the observers were trained in using the coding schemes on test videos until sufficient agreement ($k \geq 0.70$) was reached. To code the JAB, the software program 'MediaCoder' (Bos & Steenbeek 2008)

was used. We employed event counting during continuous recording. Within each 10 min of interaction, every occurrence of the participant's JAB was coded by a start and a stop code. In this way, we could gather information about the frequency of occurrence of the different JAB and about the duration of the different JAB.

Interobserver agreement

The reliability of the coding schemes was assessed by calculating the interobserver agreement between the primary investigator and a second independent rater. For every condition, 15 video records (33.3%), randomly selected, were double coded. We calculated both kappa and the percentage agreement, determined by dividing the number of agreements on the occurrence of the target behaviour by the sum of agreements and disagreements and multiplying it by 100. The kappas were substantial (Landis & Koch 1977), both for the structured observation period and for the spontaneous observation periods. For the structured observation period, we found the following: IJAB ($k \geq 0.76$) and RJAB ($k \geq 0.81$). The percentage agreement was 81% for the total IJAB and 88% for the total RJAB. For the spontaneous observation period, we found the following: IJAB ($k \geq 0.72$) and RJAB ($k \geq 0.74$). The percentage agreement was 78% for the total IJAB and 80% for the total RJAB. Scores around 80% indicate a good reliability (Cordes 1994; Banerjee *et al.* 1999).

Data analysis

We generated descriptive statistics for the RJAB and IJAB data. We quantified the percentage of time JAB were used to direct or to follow the interaction partner's attention, during the different observation periods.

First, to investigate the influence of the different context factors (objects, situation, interaction partner) on the JAB of persons with PIMD, Wilcoxon signed-rank tests were used. We chose these tests because our data were not normally distributed and because these tests are less sensitive to outliers (Siegel & Castellan 1988; Zimmerman 1994), which were present in our data. To investigate the influence of the *interaction situation*, we compared the ST_R_S[1] condition with the SP_R_S condition. By comparing these two interaction

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[1]An overview of the meaning of the abbreviations of the different conditions can be found in the textbox.

situations, we could control for the influence of the interaction partner and for the influence of the object characteristics. To explore the influence of the familiarity of the *interaction partner*, we compared the SP_DSW_S condition with the SP_R_S condition. In this way, we could exclude both the influence of the object characteristics and the influence of the interaction situation. The association between the sensitivity of the interaction partner and the JAB which persons with PIMD showed was computed by a Spearman's rank-order correlation. To study the influence of the *object characteristics*, we compared the SP_DSW_S condition with the SP_DSW_A condition. In this way, we could both exclude the influence of the interaction partner and the influence of the interaction situation.

Second, a nonparametric Friedman test of differences among repeated measures was conducted to determine whether there are any significant differences in RJAB and IJAB during the different spontaneous interactions (repeated measures). The spontaneous interactions we compared were (i) the SP_DSW_A condition, (ii) the SP_DSW_S condition, (iii) the SP_R_A condition and (iv) the SP_R_S condition.

Abbreviation	Meaning
SP_DSW_S	Spontaneous interaction with the direct support worker who uses standardized objects
SP_DSW_A	Spontaneous interaction with the direct support worker who uses adapted objects
SP_R_S	Spontaneous interaction with the researcher who uses standardized objects
SP_R_A	Spontaneous interaction with the researcher who uses adapted objects
ST_DSW_S	Standardized interaction with the direct support worker who uses standardized objects
ST_R_S	Standardized interaction with the researcher who uses standardized objects

Results

Descriptive statistics

A summary of the descriptive results for the client's IJAB and RJAB in the different observation situations can be found in Table 3.

The scores regarding the amount of sensitivity of the interaction partners ranged from 2 to 4 ($\bar{x} = 2.98$; SD = 0.58).

Table 3 Descriptive statistics for JAB in different interaction conditions (% of time)

Variable	Mean	SD	Min	Max
ST_R				
RJAB	18.8	11.0	0.0	21.5
IJAB	21.4	18.8	0.0	37.6
ST_DSW				
RJAB	20.3	13.5	0.0	26.5
IJAB	21.6	14.5	0.0	35.0
SP_R_S				
RJAB	28.2	18.3	0.0	42.2
	18.27			
IJAB	13.5	9.5	0.0	22.5
SP_R_A				
RJAB	29.0	16.5	0.0	44.8
IJAB	16.2	10.5	0.0	24.9
SP_DSW_S				
RJAB	26.6	14.7	0.0	31.6
IJAB	17.0	11.3	0.0	29.0
SP_DSW_A				
RJAB	26.6	14.8	0.0	34.6
IJAB	21.7	16.9	0.0	32.9

ST_R = standardized interaction/researcher; ST_DSW = standardized interaction/DSW; SP_R_S = spontaneous interaction/researcher/standardized objects; SP_R_A = spontaneous interaction/researcher/adapted objects; SP_DSW_S = spontaneous interaction/DSW/standardized objects; SP_DSW_A = spontaneous interaction/DSW/adapted objects.

Influence of context factors on JAB of persons with PIMD

Structure of the interaction situation

We found a significant difference between the RJAB scores in the spontaneous interaction and the RJAB scores in the structured interaction, $Z = 2.26$, $P = 0.02$. The amount of RJAB in the spontaneous interaction was higher than in the structured interaction situation. The results regarding the person's IJAB in both interaction situations show contrary results. Here, the IJAB scores in the structured interaction were significantly higher than the IJAB scores in the spontaneous interaction, $Z = 1.82$, $P < 0.01$ (Figure 2).

Interaction partner

First, regarding the influence of the familiarity of the interaction partner, we found that both the RJAB scores and the IJAB scores were not significantly different
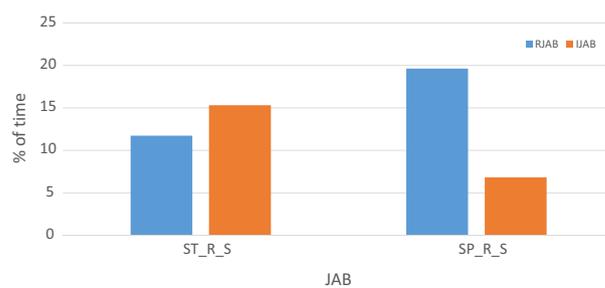

Figure 2 The influence of the structure of the interaction situation on JAB of persons with PIMD, comparing the medians of two interaction conditions.

between the observation conditions with the researcher respectively the member of the DSW team, $Z = -36$, $P = 0.29$ (Figure 3). Second, with regard to the influence of the sensitivity of the interaction partner, there appeared to be a strong significant positive correlation between sensitivity of the interaction partner and JAB of the person with PIMD, $r_s (42) = 0.682$, $P < 0.001$.

Object characteristics

Both the RJAB scores and the IJAB scores did not significantly differ between both observation conditions with standardized respectively adapted objects, $Z = -0.45$, $P = 0.65$ (Figure 4).

JAB in different spontaneous interactions

First, we found no differences between RJAB in the different spontaneous interactions, $\chi^2 (3, N = 45) = 2.36$, $P = 0.43$. Second, there was a significant difference in IJAB during the different spontaneous interactions, $\chi^2 (3, N = 45) = 14.67$, $P < 0.01$. *Post hoc* analysis with Wilcoxon signed-rank tests was conducted with a Bonferroni correction applied, resulting in a significance
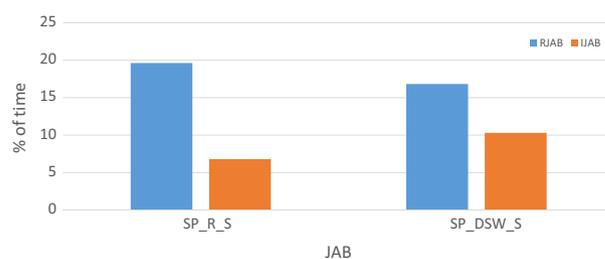

Figure 3 The influence of the familiarity of the interaction partner on JAB of persons with PIMD, comparing the medians of two interaction conditions.
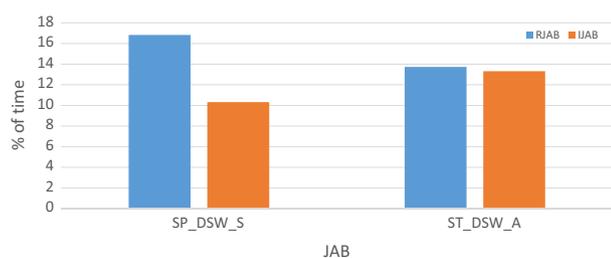
Figure 4 The influence of object characteristics on JAB of persons with PIMD, comparing the medians of two interaction conditions.

level at $P < 0.013$. Medians for the occurrence of IJAB for the SP_DSW_A, the SP_DSW_S, SP_R_S and the SP_R_A conditions were 18.69, 9.92, 7.37 and 9.69, respectively. The occurrence of IJAB was significantly higher in the SP_DSW_A condition compared to the occurrence of IJAB in the SP_DSW_S condition ($Z = 1.18$, $P < 0.01$), the SP_R_S condition ($Z = 2.63$, $P < 0.001$) and the SP_R_A condition ($Z = 1.36$, $P < 0.01$).

Discussion

Conclusions

The aim of the present study was to identify contextual aspects that influence JAB of persons with PIMD. Based on the observations of 45 persons with PIMD in different observation conditions, the results point to some clear conclusions.

First, a structured interaction condition generally reveals a higher percentage of IJAB in persons with PIMD, compared with an unstructured, spontaneous interaction condition. However, a spontaneous interaction, in turn, elicits a higher percentage of RJAB in persons with PIMD. These findings only partly confirm what we expected based on previous research in children with ASD (Whalen & Schreibman 2003; Kasari *et al.* 2005). Neerinckx H. and Maes B. (submitted) demonstrated that RJAB are earlier acquired from a developmental perspective than IJAB. It seems thus that persons with PIMD are able to show the more early developed JAB during spontaneous interactions, but that the structured situation is more desirable to elicit the later-developed IJAB.

Second, the familiarity of the interaction partner does not have an influence on JAB of persons with PIMD. They show an equal amount of RJAB and IJAB during an interaction with a familiar partner (DSW) and with an unfamiliar partner (researcher). The sensitivity of the

interaction partner, however, is positively related to the amount of JAB shown by persons with PIMD. These findings again only partly confirm our hypothesis based on previous research (Hobson *et al.* 2004; Striano & Bertin 2005) that persons with PIMD would show more JAB with a non-familiar partner who has a high amount of sensitivity towards the person with PIMD. An explanation could involve the fact that we did not examine the influence of the familiarity without the influence of the amount of sensitivity of the interaction partner. The influence of the amount of sensitivity thus could affect the influence of the familiarity, which gave us an underestimation of the familiarity.

Third, adapting objects to specific characteristics of persons with PIMD does not seem to be necessary to elicit more JAB. Both RJAB and IJAB were equally shown by persons with PIMD in an interaction using objects adapted to their abilities and preferences and in an interaction with objects without these specific adaptations to the individual needs and preferences. These findings are not in line with our expectations based on comparable research in different target groups (Jones *et al.* 2006; Van Splunder *et al.* 2006; Munde *et al.* 2012a,b). All these studies indicated the importance of adapting objects to the specific interests and preferences of persons with different impairments. A possible explanation could contain the fact that interaction partners behaved in a similar way while introducing the adapted and the non-adapted objects, in order to help the person with PIMD exploring the objects.

Fourth, although we did not find a significant effect of the familiarity of the interaction partner and of adaptations of objects used in the interaction, the combination of a familiar partner and adapted objects in a spontaneous interaction has a significant positive influence on the occurrence of IJAB by persons with PIMD. Moreover, we can conclude that the most optimal spontaneous condition to elicit IJAB is an interaction in which a familiar interaction partner (DSW) uses adapted objects that are familiar to the persons with PIMD, although in general we found that a structured interaction elicited more IJAB than a spontaneous interaction. These findings confirm what we expected regarding the influence of object characteristics (Jones *et al.* 2006; Van Splunder *et al.* 2006; Munde *et al.* 2012a,b), but contradict the previous findings about the influence of the familiarity of the interaction partner (e.g. Striano & Bertin 2005).

To finish, a general comment can be made on the absolute amount of time that the participants spent in JAB, which is only between 5 and 20% of time. This

corresponds with what we could expect based on the results of previous research (Hostyn *et al.* 2011; Neerinckx *et al.* 2013). In these studies, the researches did not measure the exact % of time that the participants spent in IJAB; they rather measured the % of intervals that contained IJAB of a person with PIMD. However, the results certainly give an idea about the limited use of IJAB by the participants in a 1 : 1 interaction.

Limitations

A number of limitations should be noted when it comes to interpreting the results. First, by using a video camera used for the video observations, we may have influenced the behaviour of the different interaction partners. It is possible that DSWs were limited in behaving like they normally do with the specific clients and did not feel comfortable about the idea that they were being filmed. Also, for the client the video camera could have limited the ability to show what they really are able to, because they may have been diverted by the presence of the camera and by the presence of the researcher in the room. Second, most of the participants are using medication for several health problems. We did not control the possible influence this medication can have on their alertness. Also, the different observation periods were not done at the same day or at the same moment on different days, which could have influenced the results. Persons with PIMD have a fluctuating and limited attention span during the day. In future research, the use of the Alertness Observation List (Munde *et al.* 2011) would allow us to control for the alertness level of the participants and to meet this limitation. Finally, in this study we only focused on the influence of context factors on the JAB that persons with PIMD show during an interaction. It is, however, important to combine these findings with the findings of earlier research on the influence of personal factors on these individual differences in JAB (Neerinckx H. & Maes B. submitted). Combining these findings can help us to build a general framework in which the different person-related and context-related factors influencing JAB of persons with PIMD can be situated, which, for its part, can lead to a better understanding of these JAB.

Practical implications

Based on the present findings, a number of implications for clinical practice can be formulated. First, it is especially important for DSWs to be aware of the added value that joint attention can have to the quality of the interactions with persons with PIMD (Hostyn & Maes 2009). Since high-quality interactions, for its part, were found to be a crucial factor for the quality of life of persons with PIMD (e.g. Wilder & Granlund 2003; Petry *et al.* 2005), we can assume that joint attention also has an indirect influence on their quality of life. Therefore, DSWs – and with enlargement all interaction partners of persons with PIMD – should be aware of their role in eliciting JAB. Stimulating persons with PIMD when they are not attentive can often result in attentive behaviour, which can be the basis to build a positive and high-quality interaction. Consequently, DSWs and others need to be actively engaged in these conditions and need to give their clients the time and the possibility to show JAB (Munde *et al.* 2012a,b). Persons with PIMD in particular can easily be overloaded and frightened and, as a result, withdraw their attention from their interaction partner or the environment. The role of the interaction partners thus becomes especially important; still, to find an optimal balance between actively stimulating the persons with PIMD and following their signals remains a challenging task. To detect the specific JAB of persons with PIMD, interaction partners have to carefully observe the persons and to be sensitive for the subtle communicative signals they use to share or to follow the attention focus. They have to take into account that persons with PIMD first need time to *receive* the stimulus that the interaction partner creates before they are able to be actively involved and to react on the stimulus (Munde *et al.* 2011).

Second, the ESCS seems to be an applicable instrument to make an assessment of the JAB of a person with PIMD. So, within practice DSWs can use the ESCS to make a meaningful assessment of JAB which their clients (can) show. This assessment can be a starting point for intervention programmes to stimulate and increase the use of these specific JAB during unstructured, spontaneous interactions. These intervention programmes should be the subject of future research, together with interventions in which DSWs get the opportunity to reflect critically on their own role in eliciting JAB in persons with PIMD.

The authors want to express gratitude to Sanne Beyens, Lotje Soetewey, Leen Theunis, Ines Van Keer and Pieter Vos for their valuable collaboration on this study.

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