Responding to Joint Attention predicts Joint Action

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Abstract

The presented study aimed to identify the developmental relations between children's early ability to participate in joint attention episodes and later ability to coordinate joint action. 109 Polish infants were assessed using the Early Social Communication Scale (Mundy et al. 2003) at 12 months and with a joint action task ('tea set') at 18 months. In the ESCS, initiation of (eye contact, gaze alternations, pointing to objects and showing them) and responding to joint attention (gaze following) were assessed. In the joint action task children scored for reactions to the experimenter's nonverbal suggestions, verbal requests and proposals that were indicators of the ability to coordinate joint action. The results revealed positive, although weak correlation between high-level responding to joint attention (following the line of regard) and children's responding to nonverbal suggestions in the joint action task (r =0.206, p =0.05). Initiating joint attention was not correlated with the ability to coordinate joint action. The results show the developmental relation between responding to joint attention at 12 months and coordination of joint action through responding to nonverbal suggestions at 18 months. However, the mechanism of this relation is still open to question.

Keywords: joint attention; gaze following; joint action; coordination of interaction; pretend play.

Joint attention and joint action

Joint attention is an ability to engage in a triadic interaction and to coordinate attention to an object of mutual interest, which develops at the end of a child's first year (Bakeman & Adamson, 1984). It is regarded as an important milestone in the development of social cognition, with great importance for development of later, more advanced social cognitive abilities (Bruner, 1995; Tomasello, 1995). Researchers investigate processes facilitating joint attention and formulate cognitively lean and cognitively rich interpretations (gaze-following vs. sharing of knowledge) (Carpenter & Liebal, 2011). Mundy et al. (2007) distinguish two forms of joint attention: responding to it and initiating it. Responding to joint attention (RJA) includes the ability to follow the direction of gaze, head turn, and pointing gesture of another person. Initiating joint attention (IJA), meanwhile, involves the infant's ability to use direction of gaze or deictic gestures to direct the attention of others and coordinate attention with a social partner.

Joint action may be defined as "any form of social interaction whereby two or more individuals coordinate their actions in space and time to bring about a change in the environment" (Sebanz et al. 2006). According to Brownell (2011), remarkably little is known about the ontogeny of joint action. She emphasizes that, although 12-month-olds engage in joint attention and are capable of gaze-following and pointing, they cannot actively coordinate joint activity until much later in the second year. Other researchers (Tomasello et al., 2005; Carpenter, 2009) agree that the foundation upon which joint action is built is shared intentionality, which refers to collaborative interactions in which participants have a shared goal and coordinated action roles for pursuing that shared goal. Hence, this account is different to that of Sebanz et al. (2006), insofar that it recognizes that a shared goal is crucial to a joint action (Carpenter, 2009) and that during a joint action the "goals and intentions of each interactant must include as content something of the goals and intentions of the other" (Tomasello et al., 2005). However, this issue is far from being clear, since the same authors state that "we don't know exactly how much of an understanding of intentional action is necessary for children to participate in collaborative activities" (Tomasello et al., 2005). Therefore, similarly to joint attention, a joint action may be interpreted in a cognitively rich or lean way.

The research aims to identify the developmental relations between the abilities to initiate and respond to joint attention (measured by the *Early Social Communication Scale*, Mundy et al., 2003) at 12 months old and abilities to coordinate joint action at 18 months. The research is part of a longitudinal project aimed at revealing the early phases of mentalizing abilities.

Early Social Communication Scale

The ESCS is a 15–20-min videotaped, structured observational measure assembled to assess children's use of several nonverbal communication skills – behavioral request, joint attention behaviors, and social interaction

behaviors. During the tasks, the experimenter and the child were seated facing each other at a small table and played with a set of toys (e.g. active wind-up toys, three hand-operated toys, a turn-taking game with a toy, looking at a book with the tester). Additionally, four posters were placed on the walls (90° to the child's right and left, and behind the child to the right and left). The measurement of RJA was coded as the percentage of gaze-following trials in which the child correctly turned its head and eyes in the direction of the tester's gaze and point. Lower-level RJA (Lo-RJA) reflects the frequency of following the proximal point or touch while browsing the book with the tester. Higher-level RJA (Hi-RJA) contains only the frequency of following the line of regard while the tester is pointing to the posters. The assessment of IJA was based on the frequency of initiation by the child of such behaviors as eye contact, gaze alternations between an active mechanical toy and the tester (lower-level IJA, Lo-IJA) and the frequency of pointing at objects or showing them (higher-level IJA, Hi-IJA).

Joint action task – "tea set"

In order to assess the child's ability to effectively coordinate joint action, a game was designed whereby the child and the tester pretended they were drinking tea (using two small cups and a teapot). The task resembled a spontaneous pretending game, inspired by the example of Tollefsen (2005), but it was structured in a manner facilitating the measurement of the child's ability to engage in activities taking into account the actions of other participants. Namely, at precisely determined points of the playing, the tester would slow down and cease their activity to wait for the child's reaction. For example, having ascertained that they had drunk all the tea, he would pick the teapot up and without saying anything stop his hand with the teapot midway. The tester verbally suggested replenishing the cup ("would you like some more tea?") only when the child did not react to the non-verbal prompt within 3-5 seconds. After continuing to pretend that he was drinking tea for a further 30-40 seconds, the tester would again announce that it was finished and would pick up his cup to stop the hand holding it midway. If the child did not react within 3-5 seconds, the tester addressed the child, asking, "Will you pour me some more tea?" The game consisted of three non-verbal attempts (the child reacted twice to the tester's outstretched hand holding the cup and once to the outstretched hand holding the teapot), which were followed, if there was no reaction to the non-verbal suggestions, by verbal requests or proposals. The child's reactions such as reaching for the teapot and pouring the tester some tea (in response to his outstretched hand holding the cup) and holding up the child's own cup (in response to the tester's outstretched hand holding the teapot) were treated as indicators of the ability to coordinate joint action. The play was structured in such a way that for the playing to take place successfully, both participants needed to coordinate their actions to allow them to complement and mesh with the actions of the partner.

Method and results

The ESCS was administered to 109 Polish infants when they were 12 months old (M=52, SD =1.3), and the joint action task was applied when they were 18 months old (M=79, SD =2.0). Fifteen of them did not engage in the pretending game and were excluded from the analysis. As a consequence, the analysis covered 94 infants and pertained to the relationship between the IJA and RJA levels at the age of 12 months and joint action coordination in reaction to non-verbal suggestions (nv-JAc) and verbal instructions (v-JAc) at 18 months.

The collected data revealed: (1) the level of IJA (Lo-IJA, Hi-IJA and IJA) was not correlated with the level of joint action: IJA and nv-JAc (r=-,009, ns), IJA and v-JAc (r=,040, ns), (2) the level of Lo-RJA was not correlated with the level of joint action: Lo-RJA and nv-JAc (r=,029, ns), Lo-RJA and v-JAc (r=,069, ns); and the level of Hi-RJA was correlated with nv-JAc (r=,206; p=0,05), but not with v-JAc (r=,089, ns); (3) linear regression (with Hi-RJA as an independent variable and nv-JAc as a dependent variable) revealed that the level of Hi-RJA predicts that of nv-JAc (R²=,042; F(1, 93)=4,05, p=,047).

Discussion

The research conducted provides data demonstrating the positive relation between the level of responding to joint attention and the ability to coordinate joint action. Specifically, the level of ability to follow the direction of gaze, head turn, and pointing gesture of another person at 12 months old predicts a child's ability to coordinate joint action, in response to a nonverbal prompt, at 18 months. To the best of our knowledge, this kind of relation, between the two forms of responsiveness to the behavior of others and coordination of one's own action with others, has not previously been identified in longitudinal experimental research.

It is worth mentioning that the ability to coordinate joint action was not correlated with the initiation of joint attention (using gaze and deictic gestures to direct the attention of others). The cause of this lack of relation may lie in the characteristics of the task adopted as the indicator of the ability to coordinate joint action. In the "tea set" activity, the joint action was to a greater degree based on the tester's activity, whereas the child's actions to a greater degree consisted in reacting adequately and completing the actions of others. Hence, it is strongly recommended that a task be designed attributing a more active role in the joint action to the child. One might expect that the level of initiation of joint attention would be linked to the ability and inclination to take on an active role in the joint action.

Despite the modest strength of the relations identified, establishing them is of interest since they reveal a developmental change in the ability to coordinate the actions one engages in on one's own with the actions of others. A 12-month-old child is only able to coordinate joint action by following the deictic actions of another person,

whereas several months later it is able to proficiently coordinate both its own actions and those of others. It remains to be investigated further to what extent this adequate completion of the actions of other people and effective coordination of joint action requires possession of a joint goal and an intention which include intentions of the other as the content, and to which it only requires the prompts included in the behavior to be identified and decoded in the frames of the conducted joint activity. This issue is also interesting from a comparative point of view, since chimpanzees are able to gaze-follow, but they spontaneously coordinate action with each other to a limited extent. It seems that chimpanzees are able to treat the behavior of others as goal-oriented, which is very helpful in competition, but unable to plan their own actions to complement those of others; this is one of the reasons for their limited capability of efficient cooperation.

Acknowledgments

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