

Eye-pointing, joint attention, interpersonal interaction and language development in children provided with AAC

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As a communication support, the ultimate aim of AAC intervention with children is to maintain and enhance inter-personal interaction. For some considerable time, researchers and clinicians concerned with AAC have been mindful of the need to establish insights into the multifaceted workings of inter-personal interaction that incorporate (or attempt to incorporate) communication aid use. For example, Arlene Kraat's 1985, then state of the art publication, which is now almost 30 years old, noted "*growing recognition that communication through non-conventional means is a complex process that requires more than the provision of a technical aid or device and symbol training*" (my emphasis)(Kraat, 1985). While the growth of interaction-focused research was perhaps less sustained in the early years immediately following Kraat's report, research on inter-personal interaction, including the practices of both aided and non-aided speakers, remains central to the AAC mission.

Studies of interaction involving AAC reflect the diversity of those provided with communication aids, and encompasses a range of methodologies. Nevertheless, research in the area may, arguably, be divided into two broad themes: (1) non-linguistic interaction, (2) language mediated interaction. This paper will focus on the former to examine issues concerned with non-linguistic interaction and language development.

Non-linguistic interaction

Infant pointing and joint attention

An important aspect of non-linguistic interaction research relevant to language development and to interpersonal communication in a broader sense concerns issues related to use of gaze behaviour as an expression of joint attention (Benigno & McCarthy, 2012). Traditionally, the term joint attention has been used to refer to a state in which two or more people share a focus of (visual) attention, commonly referred to as a joint attention triangle (see figure 1).

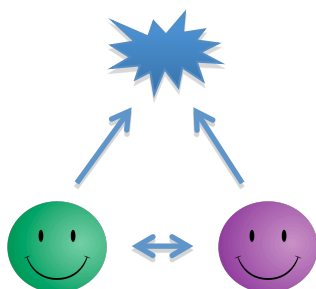


Figure 1. Joint attention triangle

However, it has been suggested that for joint attention to be truly *joint* the participants should bring about a co-ordinated orientation to an object or event such that these actions accomplish a shared ‘mental state’ in the participants. That is to stress that joint attention is not simply a state in which two or more people share a focus of (visual) attention, but that the participants evoke a shared ‘knowing’ or mental engagement about that focus of attention (Carpenter & Liebal, 2012). This ‘richer’ description of joint attention emphasises its intentional, socio-cognitive function.

For young neuro-typical children, understanding and expression of joint attention is linked with understanding others’ pointing gestures and in producing pointing themselves. It is generally accepted that children begin to show understanding of adults’ points, particularly when preceded by eye contact with the adult, and to use pointing actively themselves with a declarative motive, (to share) around the period of the end of the first year¹ (Tomasello, Carpenter, & Liszkowski, 2007)². For example, at this age infants display discontent if an adult engages with an item that is not the intended target of their declarative point, or if the adult ignores the referent of their point despite showing a positive emotional response to the child (Liszkowski, Carpenter, Henning, Striano, & Tomasello, 2004). An important feature of pointing as a mechanism for the accomplishment of joint attention concerns the use of gaze transfer between partners’ eyes/face and the object of interest. Importantly however, because a rich description of joint attention incorporates sharing attention *about* the object, to influence the other’s mental state (Tomasello et al., 2007), not just attention *to* the object, observation of gaze transfer between the child and adult may not be enough to claim that joint attention has been established. Rather, the strongest evidence for joint attention functioning as an act of ‘knowing together’ is if the participants communicate together about the shared referent, either verbally or, more interestingly/relevant to AAC field, via shared ‘communicative looks’ in relation to the referent (Carpenter & Liebal, 2012).

The emergence of pointing/joint attention (rich or lean interpretation), in children is important also because of its apparent relationship with language development (Tomasello & Farrar, 1986). Although the research literature is a little mixed in this respect, overall there appears to be growing evidence for a positive association between both children’s use and

¹ Arguably, understanding of others’ points emerges slightly in advance of child production of points. Also, children appear to produce ;

² Infants demonstrate early pointing gestures (e.g. extension of finger), at 3-4 months (Masataka, 2003), and are also known to point in the absence of engagement with others (egocentric pointing) early in infancy.

understanding of pointing, and both concurrent language ability and longitudinal language development. However, not all pointing is the same. For example, in a meta-analysis of 18 studies, incorporating 580 children, Colonnaesi and colleagues report that the social motivation for pointing is influential in that so-called proto-declarative pointing (pointing to share), shows a stronger association with language development than proto-imperative pointing, (pointing to achieve wants). Therefore pointing with a stronger socio-cognitive incentive is linked more closely with language development (Colonnaesi, Stams, Koster, & Noom, 2010). Evidence of the relationship between language and early expressions of social cognition such as pointing and the accomplishment of joint attention through pointing, lend weight to theories proposing a shared representational system between language and social-cognition in infancy that may, or may not, become more specialised as children mature.

Children's use of eye-pointing.

Because of the significance of pointing in infancy as an access method to communicative opportunities; an indicator of current socio-cognitive functioning, and as a possible indicator of current language potential, establishing the status of children's pointing ability in relation to joint attention would seem critical for families and clinicians. For children with motor disabilities who are candidates for AAC support, eye-pointing may be considered as an alternative to finger-pointing. However, clinical experience indicates that the clinical description of eye-pointing may vary between clinical teams, and between families. For instance, at a fundamental level, difficulties may exist in determining whether children's looking behaviour represents visual inspection of an item (simply looking at something) or may equate to pointing to it. In an attempt to draw together a scattered literature, and to simulate debate on this issue, Sargent and colleagues recently proposed a description of eye-pointing as follows:

The context-relevant, controlled and intentional use of sustained gaze in order to direct one or more partner's visual attention to any item or object for a deliberate communicative purpose. Other communication modes (facial expression, vocalisation, head movement and body position) may be employed, as available, to support the use of gaze. The intended meaning is established collaboratively between the child and the adult. (Sargent, Clarke, Price, Griffiths, & Swettenham, 2013, p479).

Critical elements of this description emphasise eye-pointing as deliberate action under voluntary control, involving active and purposeful guiding of others' attention, and that is

sensitive (in terms of the nature of its production) to the context of interaction, for example when used as an initiation or as a responsive action.

While deceptively simple, the act of eye-pointing as described here would in theory be underpinned by a range of skills that may be more or less available to children with severe physical disability, including not least: (i) the gaze control ability to maintain gaze fixation on a target, and to disengage and shift gaze; (ii) understanding of intentionality such as cause and effect, ie. that an action can function as a comment of request, and (iii) ability to hold and express preferences, e.g. displaying interest in objects in addition to people (faces).

From a practical perspective it would be important first to establish a core profile of children's functional gaze control skills, (see: www.ucl.ac.uk/gaze), and to examine relationships between gaze control and child characteristics (language, cognition, gross and fine motor ability).

Furthermore, given the essentially collaborative nature of eye-pointing and use of gaze in interaction more generally, important questions concern how gaze (in combination with other modalities) is used to accomplish commonplace actions (requesting, rejecting, commenting), by children and their communication partners in everyday encounters.

Given the relevance of intentionality to eye-pointing, the significance of gaze-shifting between the child and adult as an expression of pointing, and as an overture for establishing joint attention in the sense of its rich interpretation, is emphasised. While, gaze-shifting between the adult and the target may represent 'gold standard' or a more explicit expression of eye-pointing, it would seem important also to recognise the context-specific nature of communicative gaze behaviours. That is, if gaze behaviour is to be confidently treated as pointing, it might be reasonable to expect to observe consistent evidence of gaze-shifting. Once observed, families and clinicians may be more confident in treating some subsequent looking behaviours that may not include gaze-shifting as pointing; for instance, in the context of access to an AAC system. The challenge, therefore, is to establish reliable procedures for the systematic observation of looking behaviours in everyday contexts, and to develop measures to allow for multiple opportunities for eliciting gaze-shifting despite children's motor difficulties and these children's vulnerability to a range of difficulties affecting the visual system (including low visual acuity, visual field defects, and other disorders related to the broader class of deficits known as cerebral visual impairment).

In terms of systematic observation of children's looking behaviours, a set of descriptions of key aspects of gaze behaviour along a developmental progression in relation to eye-pointing is proposed here in table 1.

Table 1. Proposed eye-pointing classification scale³

V Fixes gaze	IV Indicates visual recognition	III Disengages and shifts gaze	II Social use of gaze	I Directs others' attention
Fix gaze	Fix gaze	Fix gaze	Fix gaze	Fix gaze
	Indicates visual recognition	Indicates visual recognition	Indicates visual recognition	Indicates visual recognition
		III(i) Disengages gaze from objects, shifts gaze and fixes on new objects III(ii) Disengages and shifts gaze from objects	III(i) Disengages gaze from objects, shifts gaze and fixes on new objects III(ii) Disengages and shifts gaze from objects	III(i) Disengages gaze from objects, shifts gaze and fixes on new objects III(ii) Disengages and shifts gaze from objects
			Shifts gaze from object to face and/or Shifts gaze from face to object	Shifts gaze from object to face and/or Shifts gaze from face to object
				Fixes gaze on object, shifts gaze to face, returns gaze to object OR Fixes gaze on adult, shifts gaze to object, returns gaze to adult.

If typical gaze behaviour can reliably be described according to this type of classification, clinicians and families can be supported by *shared* understanding of critical gaze behaviours. In this table then, the core mechanism is described with level I (uses eye-pointing) reflecting a traditional, 'lean' description of joint attention in that it refers to directing others' attention. As mentioned above, the extent to which shared knowing, as *joint* attention is established in relation to eye-pointing is dependent, it would seem, on the 'quality' of a shared look between participants, and/or the collaborative work in which both adult and child engage to establish collective meaning following mutual recognition of attention to a shared target.

³ Work in progress - for more information see: Michael Clarke: m.clarke@ucl.ac.uk.

This raises questions about if/how the quality of a mutual look may be objectively judged as shared and as communicative in relation to the target, outside the subjective experience of the participants themselves. As part a study of relations between imitation and joint attention Hobson and Hobson (2007) sought to identify ‘sharing looks’ from child “looks” that were not sharing in typically developing children (n=16, mean age 11;1 SD 2;0) and children with autism (n=16 mean age 11;05 SD 2;05). Shared looks were defined in terms of reciprocity (“The participant appears to register that the tester is also looking to the participant”), depth, (“The look is *into* the eyes of the tester”), and contact (“The look manifests affective contact with the tester”). While Hobson and Hobson report excellent levels of inter-rater reliability, this type of analysis (as far as we are aware) has yet to be carried out with children with severe physical disability. For children with severe physical disability, where looks are accompanied by facial expression, vocalisation, head movement etc., emotive looks between child and adult (e.g. excitement) may be reliably observable. However, for this group of children, determining the specific intended nature of the eye-point would seem critical, and for this adults and children are commonly required to engage in extended and elaborate sequences in which individual elements of the message are composed in turn before its full meaning is realised. For some children, eye-pointing to objects in the environment is a way of prompting adults into talking more expansively on the topic introduced by the communication aid (von Tetzchner & Martinsen, 1996), or where the topic is introduced by the aided speaker through their communication aid and the subsequent comment developed collaboratively between participants (Smith, 2003).

Pointing and joint attention in children with severe physical disabilities

Little is known about the developmental trajectories of children with severe motor disability affecting their whole bodies who have no intelligible speech. Clearly, such children experience difficulties physically engaging with their environments, including difficulties with producing pointing gestures. Given the relationship between pointing, the so-called ‘rich’ description of joint attention and social cognition, a further complexity exists in that it is possible that these children may be particularly vulnerable to problems with social cognition, either as a consequence of congenital impairments and/or as a result of altered environmental experiences. For example aspects of meta-representational cognition underpinning pretend and symbolic play (Leslie, 1987) may have little scope for expression and development in these children. Equally, an improvised language environment may be

influential. It is well established that patterns of interaction are characterised by adults producing a significantly high proportion of commands and known answer questions (commonly making relevant only yes/no responses next), with non-speaking children taking the role of respondent to adults' prior turns, providing minimal comments or answers (Clarke & Wilkinson, 2007, 2008; Pennington & McConachie, 1999). Where exposure to language about mental states has been proposed as a major influencing factor in development of social-cognition (e.g. Guajardo & Watson, 2002; Hale & Tager-Flusberg, 2003), concerns exist for children provided with AAC engaging in restricted interactions.

Conclusion

The apparent relationship between early expressions of joint attention, mediated in part through pointing and gaze behavior, and language development in neuro-typical children, highlights the potential benefits for research in the AAC field at the intersection of pre-linguistic interaction, social cognition and language. An important starting point for this work is to address the need to develop frameworks of description to support consistent, shared and accurate understanding of children's looking behaviors in relation to eye-pointing. Providing the tools to describe authentically child behavior in this respect can allow for an expansion of research addressing theoretically driven questions on language development in children who are provided with AAC.

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