Gestures and some key issues in the study of language development

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The purpose of the current paper is to outline how gestures can contribute to the study of some key issues in language development. Specifically, we (1) briefly summarise what is already known about gesture in the domains of first and second language development, and development or changes over the life span more generally; (2) highlight theoretical and empirical issues in these domains where gestures can contribute in important ways to further our understanding; and (3) summarise some common themes in all strands of research on language development that could be the target of concentrated research efforts.

Keywords: first language, second language, development, acquisition, ageing

Introduction

In recent years the scope of studies on language development has broadened from a fairly narrow focus on lexical and syntactic aspects at the sentence level to an interest in structures and processes at higher levels such as discourse and the interaction with other semiotic systems in communication. In parallel, studies on communication systems across modalities have provided growing empirical evidence supporting the view that gestures are a mode of expression tightly linked to language and speech (e.g. Goldin-Meadow, 2003; Kendon, 2004; McNeill, 1992, 2005). Gestures are spatio-visual phenomena influenced by contextual and socio-psychological factors, and also closely tied to sophisticated speaker-internal, linguistic processes. Under this view of speech and gesture as an inter-connected system, the study of gestures in development and the study of the development of gestures are natural extensions of research on language development, be it phylogenetically, ontogenetically, or during the lifespan of an adult. Moreover, given

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their properties and dual role as interactive, other-directed vs. internal, speaker-directed phenomena, gestures allow for a fuller picture of the processes of language acquisition in which the learner's individual cognition is situated in a social, interactive context.

The role of gestures in language development can be studied from various perspectives:

1. Gestures as a medium of language development. We can examine the role gestures play in interaction to mediate the acquisition of spoken language, their general role in communication, in establishing the socio-cognitive prerequisites for the development of language, in conveying and possibly entrenching meaning, and their connection to cognitive capacities such as working memory, etc.
2. Gestures as a reflection of language development. We can further investigate the way in which gestures develop and change in parallel to spoken language development, and the ways in which they shed light on both the product and process of language acquisition.
3. Gestures as language development itself. This approach studies the acquisition of gestures as an expressive system in its own right.

Traditionally the term language development has implicitly focused only on the gradual growth or progression of a first or second language towards the (idealised) stable model of an adult or native system. However, phenomena such as decline or regression in ability are clearly related (see papers in Viberg & Hyltenstam, 1993). For instance, regression as attested in attrition, or language loss, in adoptees, ageing bilinguals, and immigrants who stop using their first language, seems to affect the lexicon and grammar in similar ways as in progression. Not all shifts in ability lead to loss, however. Bilingual speakers may experience a decline in ability in one language when not using it without this leading to ungrammaticality. Moreover, they regain the ability when the language is brought back to use. Shifts in language dominance due to usage highlight the dynamic nature of language abilities. Development can thus usefully be seen not only as a linear process of progression, but as a complex, dynamic process that encompasses growth, decline, and any shift in both first and second languages (de Bot, 2007; de Bot, Lowie, & Verspoor, 2005). We will use the term development in this more general sense of change throughout.

The purpose of the current paper, then, is to outline how gestures can contribute to the study of some central issues in language development. Specifically, we aim to (1) briefly summarise what is already known about gesture in the domains of first and second language development, and development over the life span more generally; (2) to highlight theoretical and empirical issues in these domains where gestures can contribute to further our understanding; and (3) to summarise

some common themes in all strands of research on language development that could be the target of concentrated research efforts.

Gesture and language

In the contemporary gesture literature arguments are made for viewing gestures, language and speech as intimately linked or as forming an 'integrated system', an audiovisual 'ensemble', or a 'composite signal', depending on the theoretical approach (Clark, 1996; Engle, 1998; Kendon, 2004; McNeill, 1998). The arguments for integration come both from studies of language production and comprehension. First, in production, gestures have been found to fill linguistic functions like providing referential content to deictic expressions (*this wide*), filling structural slots in an utterance ("GIVE! [gesture: 'the book']": Slama-Cazacu, 1976, p. 221), and acting as or modifying speech acts (e.g. Bühler, 1934; Slama-Cazacu, 1976; Kendon, 1995, 2004). Second, the observed semantic-pragmatic and temporal coordination between speech and gesture lies at the heart of all theories and models concerning the relationship. Although the precise relationship between the modalities is not entirely straightforward, particularly with regard to meaning and co-expressivity, there is a general consensus that gesture and speech express closely related meanings selected for expression (see de Ruiter, 2007; Kendon, 2004; Holler & Beattie, 2003, for overviews). A third argument for integration is that speakers deliberately distribute information across both modalities depending on spatial and visual properties of interaction (e.g. Bavelas, Kenwood, Johnson, & Phillips, 2002; Holler & Beattie, 2003; Melinger & Levelt, 2004; Özyürek, 2002a). Finally, a fourth frequent argument is that gestures and speech develop together in (first) language acquisition (e.g. Mayberry & Nicoladis, 2000; Volterra, Caselli, Capirci, & Pizzuto, 2005), and that they break down together in disfluency, in aphasia, etc. (e.g. Feyereisen, 1987; Lott, 1999; McNeill, 1985). This last argument is further discussed in the papers in this volume.

In language comprehension, there is considerable evidence that gestures affect perception, interpretation of and memory for speech (Beattie & Shovelton, 1999; Graham & Argyle, 1975; Kelly, Barr, Breckinridge Church, & Lynch, 1999; Riseborough, 1981). Further to this, recent neurocognitive evidence shows that the brain integrates speech and gesture information, processing the two in similar ways as speech alone (e.g. Bates & Dick, 2002; papers in Özyürek & Kelly, 2007; Wu & Coulson, 2005). Overall, then, there is good reason to consider gestures, language, and speech as a closely-knit system.

The models attempting to formalise the relationship between gestures and speech differ in their views of the locus and the nature of the link. As suggested by

Kendon (2007) some see speech as primary and gesture as auxiliary. Others regard gestures and speech as equal partners. The first set either considers gestures to facilitate lexical retrieval (*the Lexical Retrieval Hypothesis*, Krauss, Chen, & Gottesman, 2000) or views gestures as instrumental in the process of representing and packaging imagistic thought for verbalisation (*the Information Packaging Hypothesis*, Alibali, Kita, & Young, 2000; Freedman, 1977). The second set of theories regards gestures as an integral part of an utterance. Beyond this starting-point, they differ in focus. Either they concentrate on gestures as a window on (linguistic and non-linguistic) thought (*the Growth Point Theory*, McNeill, 1992, 2005; McNeill & Duncan, 2000), or they target the interplay between imagistic and linguistic thinking (*the Interface Hypothesis*, Kita & Özyürek, 2003), or, finally, they centre on the communicative intention driving both modalities to form a deliberately coherent multimodal utterance (de Ruiter, 2000, 2007; Kendon, 1994, 2004; Schegloff, 1984). All existing accounts model the adult stable system. No theory has yet undertaken to account for development either in children or in adults.

Gesture and first language development

The field of First Language Development (FLD) has a long-standing interest in gestures. Infants' gestures have traditionally primarily been explored as relevant features of a prelinguistic stage, as behaviours that precede and prepare the emergence of language, identified exclusively with speech. More recently, the view of adult language as a gesture-speech integrated system has prompted the need to understand how the gesture-speech relationship is established in infancy and how it evolves towards the adult system.

The earliest development

Infants begin to communicate intentionally through gestures and vocalisations and later with words (see Liszkowski, Stefanini et al., this volume). Gestures and speech are equal partners — in the majority of cases the communicative signals produced by children are expressed in both modalities, gestural and vocal. A key question is whether the two modalities are integrated from the very beginning, or are initially separate to become an integrated system only with development (McNeill, 1992, 2005). Some studies indicate that the gestural and vocal modalities are semantically and temporally integrated from the earliest stages (Capirci, Contaldo, Caselli, & Volterra, 2005; Iverson & Thelen, 1999; Pizzuto, Capobianco, & Devescovi, 2005), while others report that asynchronous combinations of gestures

and words are more frequent than synchronous ones in an initial developmental period (Butcher & Goldin-Meadow, 2000; Goldin-Meadow & Butcher, 2003).

Despite these differences, all agree that deictic gestures appear before the end of the first year and that they fulfil the basic function of drawing the interlocutor's attention to something in the environment. These gestures include REQUESTING (extending the arm toward an object, location or person, sometimes with a repeated opening and closing of the hand), SHOWING (holding up an object in the adult's line of sight), GIVING (transferring an object to another person) and POINTING (index finger or full hand extended towards an object, location, person, or event). The referents of these gestures can be identified only in the physical context in which communication takes place.

Around 12 months children start to produce other more content-loaded types of gestures, referring, like first words, to action schemes usually performed at this age with or without objects (e.g. bringing the handset or an empty fist to the ear for TELEPHONE/PHONING. Some gestures refer to action schemes that are non-object-related (e.g. moving the body rhythmically without music for DANCING to request that music be turned on) or to conventional actions (waving the hand for BYE-BYE) with forms more arbitrarily related to their meaning. The terminology used for these gestures ("conventional", "referential," "symbolic", "iconic", "characterising", "representational") is variable, and has changed considerably over the years, even in the work of the same author(s), reflecting changes both in methodology and theoretical perspectives. The communicative function of such gestures appears to develop within routines similar to those considered to be fundamental for the emergence of spoken language. Their forms and meanings are established in the context of child–adult interaction. The first gestures and the first words involve the same set of concerns: eating, dressing, exchange games, etc., and they are initially acquired with prototypical objects, in highly stereotyped routines or scripts. At roughly parallel rates, they gradually "decontextualise" or extend out to a wider and more flexible range of objects and events.

The role of input

The remarkable similarities between production in the gestural and the vocal modalities during the first stages of language acquisition raise interesting issues regarding the communicative and linguistic role of early words and gestures. Symbolic actions produced in the gestural modality have often been seen as communicative and referential irrespective of the contexts of use (for a discussion, see Caselli, 1994). Around 13 months there is a basic equipotentiality between the vocal and the gestural channels (Erting & Volterra, 1990). Differences in the type of input to which children are exposed influences the extent to which the

manual or spoken modality is used for representational purposes and assumes linguistic properties. For example, children systematically exposed to sign language input acquire and develop a complete language in the visual gestural modality (see Schick, Marschark, & Spencer, 2006). Comparisons between deaf and hearing children suggest that all children, regardless of whether their primary linguistic input is spoken or signed, use gestures to communicate, in particular in the transition stage to symbolic communication (Volterra, Iverson, & Castrataro, 2006). Although the relationship between gesture and sign language in general and in development has received little attention to date, recent research suggests that gesture is as essential a part of sign language as it is of spoken communication (Emmorey, 1999; Liddell, 2003).

Typically developing children are clearly encouraged by parents to rely much more on vocal symbols for communication. However, it has been suggested that gestural input may facilitate the acquisition of spoken words, as in the case of "baby signs" or 'enhanced gestures' used in conjunction with speech (Goodwyn & Acredolo, 1998; Goodwyn, Acredolo, & Brown, 2000). A possible explanation for this effect, found also in children with developmental disorders, is that exposure to enhanced gesturing provides children with opportunities to master new forms in both the vocal and manual modalities (Abrahamsen, 2000).

Culture and adult input may influence both the form and the frequency of representational gestures. Many studies have reported more frequent production of representational gestures by Italian children who are immersed in a 'gesture-rich' culture (see the discussion in Kendon, 2004, Ch. 16). In particular, the representational gestures produced by Italian children include numerous object/action gestures (e.g. EATING, PHONING) and attributive gestures (e.g. BIG, HOT), whereas American children almost exclusively produce conventional gestures (e.g. HI, YES, ALL GONE) (Iverson, Capirci, Volterra, & Goldin-Meadow, 2008). Cross-cultural longitudinal studies of spontaneous interaction should reveal how similarities and differences in the way object/action gestures versus more conventional social gestures develop.

The relationship between speech and gesture

Interesting findings on the relationship between children's production of action and gestures and early (receptive and expressive) word repertoires have been collected through the MacArthur Bates Communicative Development Inventory (MBCDI). This is an instrument designed to explore and assess typically developing children's early communicative and linguistic development (Fenson et al., 1993). In particular, it has been shown that there is a complex relationship between early lexical development in comprehension and production, and action-gestures (Caselli &

Casadio, 1995). Around 11–13 months, the productive repertoire of action-gestures appears to be larger than the vocal repertoire, but in the following months the mean number of words and action-gestures are more similar. More interestingly, at this early age there is a significant correlation between words comprehended and action-gestures produced (Fenson et al., 1994). These findings suggest that the link between real actions, actions represented via gestures, and children's vocal representational skills may be stronger than has been assumed thus far.

Another important finding is that in all cultures investigated to date the first utterances (combinations of two or more meaningful communicative elements) are crossmodal. Various studies highlight that deictic gestures (notably POINTING) play a special role in two-element utterances. Combinations of a POINTING gesture with a representational word are the most productive types of child utterances. These gesture-speech combinations can refer to a single element or to two distinct elements. Complementary and supplementary gesture-speech combinations reliably predict the onset of two-word combinations, underscoring the robustness of gesture as a harbinger of linguistic development (Butcher & Goldin-Meadow, 2000; Capirci, Iverson, Pizzuto, & Volterra, 1996; Iverson et al., 2008; Iverson & Goldin-Meadow, 2005). Many constructions (e.g. predicate+argument like "POINT (to chair) saying "mommy" to ask mommy to sit on the chair) appear in supplementary gesture-speech combinations several months before the same construction appears in speech (e.g. "sit mommy" or "mommy sit"). The production of a supplementary *deictic* gesture-word combination appears early, whereas supplementary *representational* gesture-word or two-word combinations, which require the child to retrieve two symbols each conveying a different piece of semantic content, appear later. The production of a single word and identification of another referent in the context through a deictic gesture supposedly places fewer cognitive demands on the child than the combination of two representational elements and presumably fits the child's current cognitive capacities (Özcaliskan & Goldin-Meadow, 2005).

The study of children with atypical input or development can further illustrate how gesture appears to be related to cognitive and linguistic development in infancy. An example of how gesture may compensate for specific impairments of the spoken abilities is children with Down syndrome (DS). The neuropsychological profile of DS children is characterised by a lack of developmental homogeneity between cognitive and linguistic abilities. The linguistic abilities of DS children are poorer than expected based on their overall cognitive level (e.g. Chapman & Hesketh, 2000). These children appear to compensate for poor productive language abilities through greater production of gestures. There is ample evidence that the gap between cognition and productive language skills becomes progressively wider with development among DS children (Chapman, 1995; Franco & Wishart, 1995).

However, with increasing cognitive skills and social experience these children also develop relatively large repertoires of gestures (Caselli et al., 1998; Stefanini, Caselli, & Volterra, 2007; Stefanini, Recchia, & Caselli, this volume). The compensatory use of gesture can be enhanced, particularly if children are encouraged through the provision of signed language input (cf. Abrahamsen, 2000). Higher gesture rates associated with speech difficulties have also been reported for other clinical populations such as children with specific language impairment (Evans, Alibali, & McNeil, 2001; Fex & Månsson, 1998).

Later development

Given that gesture usage appears to be related both to the general cognitive level and to phono-articulartory abilities, it is important to examine children in later childhood and at different stages of linguistic development. The development whereby children's gestures become organised into the adult speech-gesture system have not been fully described. Very few studies have explored the development of this system after the two-word stage when other types of gestures, such as 'rhythmic' or 'emphatic' gestures, start to appear. Mayberry & Nicoladis (2000) followed 5 French-English bilingual boys longitudinally (from 2 years to 3;6 years), showing that children from age 2 onwards largely gesture like adults with regard to gesture rate and meaning. Interestingly, different gesture types developed differently such that the use of iconic and beat gestures correlated with language development, whereas the use of pointing gestures did not. Children between 16 and 36 months use gestures and speech in agreement and refusal constructions with their mothers somewhat differently from adults (e.g. Guidetti, 2005). Looking at more sophisticated language use, children from 4 to 5 years productively use idiosyncratic, content-loaded gestures during narratives (McNeill, 1992). Colletta (2004), recording adult-child spontaneous interactions, has described the development of conversational abilities in school-age children. Younger children produce very few metaphoric, abstract deictic gestures and beats, which become more frequent in the production of older children.

Finally, research investigating gesture production in school-aged children in problem-solving tasks, reasoning about balance or mathematical equivalence, indicates that children convey a substantial proportion of their knowledge through speech-accompanying gestures (Alibali & Goldin-Meadow, 1993; Church & Goldin-Meadow, 1986; Pine, Lufkin, & Messer, 2004). In some cases children's gesture-speech 'mis-matches' predict learning. Children whose speech and gestures 'mismatch' are more likely to benefit from instruction than children whose speech and gestures match. These studies indicate that gestures can reveal not only what children are thinking about but also their learning potential.

In sum, even if differences in data sets (e.g. ages considered, gesture types described), in methodology and terminology make it challenging to compare findings across studies, the available data suggest that the role of gesture in spoken language acquisition and development changes according to different stages and communicative/interactional contexts. Around one year of age gesture plays a crucial role in the construction and expression of meaning. In the following stages gesture production develops together with speech. At later stages still, gesture production appears to decrease in some linguistic contexts (e.g. naming tasks) although it is frequent with speech in others (e.g. narratives). These findings together indicate that any study on the development of language should include and pay particular attention to gestures.

Gesture and second language development

In recent years the interest in the relationship between gestures and Second Language Development (SLD or L2D) has grown considerably. Studies suggest that gestures play an important role in SLD and should be seen both as a resource in learning and as a component of language proficiency in its own right (cf. Gullberg, 2006b, 2008; Gullberg & McCafferty, 2008). Again, if gestures and speech are seen as an integrated system, then factors that play a role in SLD in general may also play a role in the development of gesture, and conversely, gestures may provide further information on the effects of such factors. Therefore, a large part of the SLD research agenda is also relevant for gesture where a number of traditional topics can fruitfully be addressed taking gestures into account.

Cross-linguistic influences (CLI) or transfer

One of the most widely studied aspects of SLD is cross-linguistic influence, that is, the impact of existing languages on the acquisition and use of new ones. Traditionally this research has been concerned with the effect of the first language (L1) on later learned languages, but research on lexical processing in bilinguals and research on language attrition and language loss has shown that later learned languages may influence the first language (Cook, 2003; Costa, 2005; de Bot & Clyne, 1994; Köpke, Keijzer, & Weilemar, 2004; van Hell & Dijkstra, 2002). Recent studies have also demonstrated an impact of the L2 on the L1 in gestures (e.g. Brown, 2007; Brown, this volume; Brown & Gullberg, 2008; Pika, Nicoladis, & Marentette, 2006).

A growing body of work suggests that native speakers of typologically different languages, such as English on the one hand, and Spanish and Turkish on the other,

gesture differently, both in terms of gestural form and timing, as a reflection of how these languages encode and express meaning components of motion like path and manner (e.g. Duncan, 1994; Kita & Özyürek, 2003; McNeill, 1997; McNeill & Duncan, 2000; Özyürek, Kita, Allen, Furman, & Brown, 2005). Further studies have also shown that L2 learners of these languages do not necessarily gesture like target language speakers, but display traces of their L1s in their gesture production either in terms of timing, aligning their gestures with different elements in speech compared to native speakers (e.g. Choi & Lantolf, 2008; Kellerman & van Hoof, 2003; Negueruela, Lantolf, Rehn Jordan, & Gelabert, 2004; Stam, 2006), or in terms of gestural forms, expressing different semantic content in gestures compared to native speakers (e.g. Brown, 2007; Brown & Gullberg, in 2008; Gullberg, submitted; Negueruela et al., 2004; Özyürek, 2002b; Yoshioka & Kellerman, 2006). Such findings are often discussed in terms of Slobin's notion of 'thinking for speaking' (e.g. Slobin, 1996), that is to say, ways in which linguistic categories influence what information you attend to and select for expression when speaking. The argument for L2 is that L1-like gesture patterns may reveal whether L2 speakers continue to think for speaking in the L1 rather than in L2-like ways.

A number of questions need to be addressed in this domain. A crucial issue concerns how to identify and study gestural practices typical of a given language and culture. It is a real difficulty that so little is known about language-specific gesture patterns in terms of frequency, gestural forms, use of gesture space, and semantic expression. An absolute prerequisite for the study of CLI in gestures in L2 is therefore a better understanding of gestural practices across languages in native performance. Currently, any study on L2 behaviour is a triple study where the native behaviour in both source and target language needs to be described before learner behaviour can be considered. If gestures and L2 studies are to follow in the steps of general SLD research, effects of other known languages (L3, Ln) should also be taken into account, pushing the boundaries even further.

It is equally important to point out that in contrast to the traditional focus on 'errors' in SLD (see papers in Richards, 1974; van Els, Extra, van Os, & Janssen van Dieten, 1984), a different approach is necessary when considering gestures in L2 production. Since there can be no absolute 'grammaticality' of gesture performance, preferential usage patterns must instead be established with corresponding gradient native scales of appropriateness or acceptability. For instance, Duncan (2005) examined 20 native English speakers retelling a cartoon and found that 64% of the manner gestures coincided with manner verbs, while 33% of the manner gestures were linked to other elements such as ground or path. In contrast, 20 Spanish speakers engaged in the same task aligned only 23% of their manner gestures with manner verbs, while 58% coincided with ground or path elements. The range of variation defines what is 'nativelike' and allows for an equal range

of possible behaviours for L2 learners that would still qualify as 'nativelike'. This opens for a more gradient and sophisticated view of L2 performance in general beyond the narrow domain of target-like gestures.

CLI effects have mainly been studied looking at representational (iconic) gestures. It is unknown whether effects of CLI can be found for other types of gesture practices. For instance, given that gestures supposedly align with speech rhythms and language-specific prosodic patterns, it seems plausible that rhythmic patterns of gesturing will transfer into an L2 along with a foreign accent. Similarly, it is possible that cross-linguistic differences in ways of managing interaction might transfer into an L2 in the use of interactive and 'pragmatic' gestures (e.g. Bavelas, Chovil, Lawrie, & Wade, 1992; Kendon, 2004). To date, no study has examined these issues.

The studies of L2 gestures occasionally display dissociation between surface form and gesture whereby L2 learners say one thing (in L2-like fashion) and gesture another (in L1-like fashion) (e.g. Özyürek, 2002b; Stam, 2006). In most studies gesture is more conservative than speech, such that speech seems to change more readily towards the L2 target than gestures. This phenomenon is mainly interpreted as indicating transfer of L1 representations, perspectives, or *thinking for speaking*. However, similarly to the study of CLI in spoken language, to determine whether a particular phenomenon is caused by CLI/transfer, or whether it is a general learner phenomenon, requires methodological triangulation (cf. Jarvis, 2000). At the very least, it is necessary to examine learners from two different source languages learning the same target language to tease apart such effects.

Further, very few attempts have been made to theoretically account for the fact that L2 speakers do and say different things, an L2-specific form of speech-gesture discrepancy. A question that arises is what representations actually underpin L2 surface forms, especially when these look target-like but gesture does not, and why it should be that speech changes before gesture. Do gestures have a privileged link to conceptual representations relative to speech? How dissociated can speech and gestures be and still be said to reflect the same representation?

A different set of questions pertains to how gestures that seem not quite target-like from a native speaker's point of view are perceived by native speakers. The inclusion of gesture in assessments of L2 speakers expands the number of dimensions along which learners' production can vary relative to native speakers. In this sense, gesture data raise important questions concerning the 'native speaker standard' (cf. Davies, 2003), crucial in many studies of SLD. The discussion of critical periods for language learning and the degree to which adult learners can become nativelike is central to theories of adult L2 acquisition (cf. Birdsong, 2005). Gestures definitely raise the stakes for learners. However, no studies have systematically examined native perception of 'foreign gesture', nor its potential interactional

consequences. Although a number of studies show that learners' gesture production affects assessments positively such that learners are deemed more proficient if they gesture than if they do not (Gullberg, 1998; Jenkins & Parra, 2003; Jungheim, 2001; McCafferty, 2002), no studies so far have directly tested for effects of 'foreign gesture'.

Gesture and learner-general phenomena

SLD research does not restrict explanations of properties of the L2 to effects of the L1 or other languages learned. SLD studies also look at learner behaviour as a systematic and regular variety in its own right, as an *interlanguage* (Selinker, 1972), with properties determined both by general learning mechanisms and by the specific languages involved. Again, in such a perspective, a number of issues arise where gestures might provide important insights. One such issue concerns how language learners handle different types of difficulties at a given proficiency level, such as managing lexical, grammatical, and discourse related problems at the same time in real time. The analysis of gestures and speech in conjunction provides a fuller picture of such problem-solving. For instance, studies of Moroccan and Japanese learners of French show how learners move from using mainly representational gestures, complementing the content of speech, towards more emphatic or rhythmic gestures related to discourse (Kida, 2005; Taranger & Coupier, 1984). This suggests a transition from essentially lexical difficulties and lexically based production to more grammatical problems related to discourse. More careful charting of what gestures are produced by learners with particular proficiency profiles has potential pedagogical and diagnostic applications.

The acquisition of gestures can and should also be studied in its own right. Just as we need to find out how children come to gesture in adult-like and culture-specific ways, so we need to know whether L2 learners ever come to gesture like native speakers. Although some attention has been given to L2 users' comprehension of conventional or quotable gestures ('emblems') (e.g. Jungheim, 1991; Mohan & Helmer, 1988; Wolfgang & Wolofsky, 1991), nothing is known about whether L2 learners ever produce such culture-specific gestures, which may show the same acquisition difficulties as idiomatic expressions (e.g. Irujo, 1993). For instance, do L2 learners learn to produce appropriate gestural forms such as distinguishing the HEAD TOSS from the HEADSHAKE (Morris, Collett, Marsh, & O'Shaughnessy, 1979), do they learn to POINT in culturally appropriate ways (see papers in Kita, 2003), and do they learn to respect handedness taboos (e.g. Kita, 2001)? Even less is known about whether L2 learners acquire and produce language-specific non-conventionalised gestural practices. If they do, this raises important questions about implicit learning of both form and meaning, crucial to the domain of SLD. If

they do not, it raises familiar SLD issues about why learners do not notice or 'take in' certain aspects of the input despite extended exposure (e.g. Robinson, 2003). It is perhaps particularly interesting to consider visual phenomena like gestures since they are often assumed to be inherently 'salient', and to have an attention-directing, enhancing effect in their own right. If they did, they should be easy to acquire. Again, next to nothing is known about this question.

A closely related issue is what might be learnable and indeed teachable (and therefore assessable) in terms of gesturing. While it may be possible to teach forms and meanings of emblems, it is much less clear that other aspects of gestural practices are teachable. Even when gestures are on the classroom agenda, an explicit link is seldom made between language and gesture. Furthermore, research in this domain should consider the possible differences and similarities between spontaneously produced gestures and gestures explicitly deployed for teaching purposes (e.g. Lazaraton & Ishihara, 2005; Tellier, 2006). It is possible that features noted for 'instructional discourse' like child- or foreigner-directed gestures share properties with gestures employed in language classrooms. A further step is to consider learners' interpretations of teachers' gestures rather than examining teachers' gestures in social isolation (cf. Sime, 2006). Answers to questions concerning learnability and teachability are wide-open.

Gesture across the lifespan

Under the view that language development encompasses all shifts, a number of further domains become relevant such as the development of rhetorical styles and registers, but also language attrition in bilinguals, and changes in language related to ageing. Changes in language can of course also be related to disease, as in aphasia, split-brain surgery, etc., but we leave those changes aside in this overview (but see e.g. Feyereisen & de Lannoy, 1991; Goodwin, 2002; Lausberg, Zaidel, Cruz, & Ptito, 2007; Lott, 1999; Rose, 2006).

With regard to the development of rhetorical styles and gestures, something is known about the development of narrative skills and concomitant changes to gesture in later childhood. For instance, Cassell (1988) demonstrated that children's production of beats becomes adult-like only with increasing development of narrative skills, specifically when children can alternate between different narrative levels. Very little is known, however, about the development of other rhetorical skills such as gestures in different registers, sermons, public speeches, etc. Although a small literature explores politicians' gesture practices (e.g. Calbris, 2003), the focus is typically on the accomplished speaker, not on the development of the speech-gesture repertoire.

In the domain of language attrition due to immigration or bilingualism, nothing at all is known about gesture practices. Assuming that gesture and speech are connected, it seems plausible that the gesture practices might also be affected if skills in the spoken first language are lost. However, given that gestures can also be recruited for other purposes, it is an empirical question whether this happens or not.

Gestures and ageing

A recent overview of research on gestures over the lifespan suggests that there is very little research on gestures in older age groups (Tellier, in press). There is a substantial body of research on non-verbal communication and ageing, and some of these studies have also considered gesture use and interpretation (Montepare & Tucker, 1999). The perspective taken is often a compensatory one. That is, communication problems emerge with age due to a decline in speech-motor skills and hearing. The assumption is that these problems are compensated for by gesturing (e.g. Cohen & Borsoi, 1996; Feyereisen & Havard, 1999). There are several problems with this approach. First, the decline of speech production in ageing is not well-established. Second, any decline seems to be co-affected by variables such as continuous use of the language and level of education. Third, the groups considered are typically fairly young (60s and early 70s) and comparisons between age groups are cross-sectional. Age-related language problems are more likely in the 75+ age group, in particular when there are other health problems and the level of education is low (de Bot & Makoni, 2005). Finally, there is considerable variation within and between age groups. So a simple young/old comparison may not be informative.

It is possible that there are specific age-related types of gesturing, probably more due to specific motor patterns than to language issues. For instance, the control of small movements may be reduced, leading to larger movements. It is also possible that with decreasing flexibility of joints, changes in spinal curvature, etc., there is a reduction in gesture size, gesture speed, etc. (cf. Laver & Mackenzie Beck, 2001). Both changes may be given (un-intended) semiotic importance by onlookers. The field of gestural practices in ageing is desperately under-researched.

Common themes

The preceding sections have briefly outlined some of what is known about gestures and language development, with some emphasis on questions that remain open to investigation in each domain. There are, however, clearly general themes that are common to all studies of language development and gesture.

The role of gestures in the input

In studies on language development the precise role of input, that is, what language users hear and see, is hotly debated. Both in studies of FLD and SLD a familiar debate concerns whether input is simply a trigger of innate knowledge and structures (Pinker, 1989; Wexler & Culicover, 1980; White, 2003), or whether language development is based on detailed properties of the input such as frequencies and on usage (Ellis & Larsen-Freeman, 2006; Tomasello, 2003). In SLD the role of input is debated partly because L2 learners seem not to attend to what is in the input, namely 'correct' pronunciation, grammar, etc., as seen in their tendency to maintain foreign accents and grammatical peculiarities even after many years of teaching and exposure.

A well-known hypothesis states that a prerequisite for input to be useful to learning is that it is comprehensible (e.g. the *Comprehensible Input Hypothesis*, Krashen, 1994).[1] In this perspective, gestures seem to play an important role. Interlocutors are known to attend to and make use of gestural information, for instance, to improve comprehension in noise (Rogers, 1978). It is also clear that gestures in the input can improve learning in general such as the learning of maths and symmetry (Singer & Goldin-Meadow, 2005; Valenzeno, Alibali, & Klatzky, 2002). A natural assumption is therefore that gestures that convey speech-related meaning should improve language learners' *comprehension* and possibly also *learning* of language. Indeed, adults, teachers and other 'competent' speakers seem to think so. All forms of didactic talk or 'instructional communication' studied — whether by adults to children ('motherese') or by adult native speakers to adult L2 users ('foreigner/teacher talk', Ferguson, 1971) — is characterised by an increased use of representational and rhythmic gestures (e.g. Adams, 1998; Allen, 2000; Iverson, Capirci, Longobardi, & Caselli, 1999; Lazaraton, 2004). However, few studies test actual effects on *language* learning. There is some evidence that gestures improve the learning of new adjectives in English children (O'Neill, Topolovec, & Stern-Cavalcante, 2002). Very few studies empirically test the connection between gestural input and learning outcomes in SLD (for exceptions, see Allen, 1995; Sueyoshi & Hardison, 2005; Tellier, this volume). Moreover, facilitative effects of gestures may differ depending on the linguistic units tested and be more evident for lexical than grammatical material (e.g. Musumeci, 1989). Different types of gesturing may also have different effects. Again, all these issues remain wide open. It is also an empirical question to what extent children and adult learners mirror the gesture input in their own gesture production.

A related question is to what extent learners affect their own input by their spoken and gestural practices in interaction. It has been suggested that learners' gestures might help promote positive affect between learner and adult/native

speaker, which might ultimately promote learning (e.g. Goldin-Meadow, 2003; McCafferty, 2002). It has also been suggested that adult and native listeners in general tailor their production to learners based on the learners' gestures (e.g. Goldin-Meadow, 2003). This is in line with the well documented observation that interlocutors synchronise or accommodate to each other in interaction also as regards gestures (Bavelas, Black, Chovil, Lemery, & Mullett, 1988; Condon & Ogston, 1971; Kimbara, 2006; Wallbott, 1995). It is an open question to what extent such synchronisation might affect language learning (cf. discussions of structural priming as a means of learning, e.g. Bock & Griffin, 2000; Branigan, Pickering, & Cleland, 2000).

The role of gestures in the output

The complementary notion also plays a role in development, namely that production is crucial to acquisition. Bruner (1983) suggested that (first) language is learned through use and a similar notion is present in the 'output hypothesis' in SLD. This states that new language knowledge only becomes automatised if used for production (Gass & Mackey, 2006; Swain, 2000). In a parallel fashion, it has been shown that the production of gestures promotes learning of other skills, such that adults and children who gesture while learning about maths and science do better than those who do not (Alibali & DiRusso, 1999). General recall also improves when participants enact events (e.g. Frick-Horbury, 2002). Evidence for an effect of gesturing on the acquisition of *language* is again much scarcer. Although it has been suggested that gesturing might help L2 learners internalise new knowledge on theoretical grounds (Lee, 2008; McCafferty, 2004; Negueruela et al., 2004), and although teaching methods relying on embodiment exist (e.g. *Total Physical Response*, Asher, 1977), it remains an empirical question whether any real, long-term learning effects can be demonstrated for gesture production in L1 or L2 (for short-term effects in L2, see Tellier, 2006).

Variation and individual differences

All language development is characterised by individual variation. First language development is relatively uniform — at least regarding final outcome — in comparison to SLD, which is characterised by highly variable outcome. In SLD the effect of a range of psycho-social factors have been explored, such as intelligence, language aptitude, memory capacity, attitudes, motivation, personality traits, and cognitive style (e.g. de Bot et al., 2005, pp. 65–75; Dörnyei, 2006; Verspoor, Lowie, & van Dijk, 2008). For instance, intelligence matters more in tutored than in untutored SLD, and more in grammar learning than in other skills. The correlations

between language aptitude tests and free oral production and general communicative skills are generally low. Working memory capacity seems to be lower generally in L2 than in L1 (Miyake & Friedman, 1999), etc. No study of such factors in SLD has to date considered gestures either as a co-variable or as a measure of any of the factors despite the fact that the influence of some of these factors on gestures has been extensively studied. For instance, effects of personality and psychological types (e.g. introvert vs. extrovert) on nonverbal behaviour have received a lot of attention (see Feyereisen & de Lannoy, 1991, for an overview), and verbal vs. spatial fluency (Hostetter & Alibali, 2007), etc., have been documented. However, no studies have combined these perspectives although a number of possible links can be hypothesised.

Recent studies have suggested that gestures help reduce cognitive load (e.g. Goldin-Meadow, Nusbaum, Kelly, & Wagner, 2001; Wagner, Nusbaum, & Goldin-Meadow, 2004). Such an effect would be important in L2 production (cf. Gullberg, 2003, 2006a) where individual differences in working memory and proficiency might conspire to make such effects more important. A key expansion on the hitherto rather uninformative observations that L2 learners gesture more in the L2 than in the L1 would be to examine the relationship between fluency, processing units, and gesture production more closely in these terms. For instance, at stages where L2 learners are not very fluent and proceed almost word by word, they seem to produce one gesture for every unit/word. Once they start stringing together more material in chunks, the gesture rate also goes down (Gullberg, 1998, 2006a; Nobe, 2001). This suggests a possible link between working memory, fluency and gesture production.

Similarly, individual differences in cognitive style and personality affect interaction patterns and thereby the extent to which L1 and L2 learners create situations of rich input for themselves (cf. Goldin-Meadow, 2003). While this has been examined in FLD, no studies to date have explored such issues in SLD.

Finally, there is inter- and intra-individual variation in adult, native gesturing, depending on social setting, degree of formality, shared knowledge, ambiguity, expertise, the content of speech, etc. Many aspects of individual variation in adult, native gesturing are not well understood, such as why some speakers gesture more than others, and why the same speaker sometimes chooses to gesture and sometimes not (Kendon, 1994). To qualify the possible range of behaviours in adult native speakers while allowing for variation is crucial to studies of language development and gesture. Rather than looking at behaviour outside of the 'typical' as 'noise' in the data, a more productive approach is to look at variation as a meaningful source of information. This is not to say that we need to explain every single instance of a deviation from a general pattern. As in other areas of language development, variation is a reflection of the developmental process resulting from

the interaction of many internal variables that cannot be taken apart to study the impact of each individual factor (van Dijk & van Geert, 2005; Verspoor et al., 2008). Studies of gestures and language development will have to be methodologically creative to find ways of taking variation into account.

Gesture as compensation

In many parts of the language development literature, a general and often tacit assumption is that children and adults alike produce gestures mainly to overcome the gap between their communicative intentions and the expressive means at their disposal. That is to say, gestures are viewed as a compensatory mode of expression. However, the theoretical issues underlying such a view are rarely discussed. First, compensation as a notion is often ill- or undefined. For instance, spoken language acquisition research shows that not all learner behaviour is best characterised as strategic problem-solving. Children and adult learners all over-generalise, not as a means of compensation, but as part of the developmental process. Furthermore, adult learners are often communicatively fluent in an L2 even though their systems do not look like those of native speakers. Conversely, not all difficulties are overt. Learners may avoid difficulties by changing their intention when the expressive means do not match. The general difficulties involved in identifying and defining compensatory behaviour has received attention in SLD studies (see papers in Kasper & Kellerman, 1997), but much less so in studies of FLD, and are virtually absent from studies considering gesture as compensation.

A related issue relevant both to acquisition and gesture studies is the question whether compensation is intended for the speaker or for the addressee. That is, is it a speaker-internal solution to a problem, an interactional solution, or both? These questions echo familiar debates in the gesture literature regarding gesture production (cf. the input/output distinction above), but they are equally relevant for developmental, compensatory issues (e.g. Gullberg, 1998).

A third question concerns what parts of spoken language gestures can compensate for. The focus has traditionally been on lexis and meaning, but lexical access, grammar, discourse, conceptualisation, and problems of linearising global information have all been implicated in gestural compensation (Alibali et al., 2000; Gullberg, 1999, 2006a; Hostetter, Alibali, & Kita, 2007; Pine, Bird, & Kirk, 2007).

Finally, of theoretical relevance for gesture studies is the question how gestures can compensate for linguistic expressions, and how compensatory gestures are defined and function. In adult, 'competent' users, the speech-gesture integration is multifaceted and may not be obligatory and automatic. 'Competent' speakers can choose to decouple speech and gesture. This raises important questions about co-expressivity, however that is defined. Gestures that express non-redundant

meaning from speech are not typically considered 'compensatory' in cases of mature, adult native speakers, whereas such instances are often seen as compensatory in developing speakers. Further, a number of familiar questions in the debate on gesture production could be cast in terms of compensation, such as whether gestures help lexical retrieval (activate word forms) (Krauss et al., 2000), or help with conceptualisation or information packaging (Goldin-Meadow, 2003; Kita, 2000), However, surprisingly, these theoretical notions are rarely touched upon in discussions of 'compensatory' gestures in development (for notable exceptions, see Nicoladis, 2007; Nicoladis, Mayberry, & Genesee, 1999). Although there are exceptions in the literature on children's development, notably the literature on 'mis-matches' (e.g. Goldin-Meadow, 2003) and on lexical access in children (e.g. Pine et al., 2007), even these studies do not typically discuss explicitly what defines some gestures as compensatory. In studies of adult L2 users' gestural behaviours, theoretical discussions of gestural compensation are almost entirely absent. The properties that make some gestures compensatory and others not need to be discussed and elucidated if we are to form a better understanding of the role of gesture in language development.

In sum, the notion of compensation raises important theoretical issues both for studies of language development and for gesture studies. We need to consider how and when to view the function of gesture as mainly compensatory, to formulate independent defining criteria, etc. (e.g. Goodwin & Goodwin, 1986). Developmental data that raise important issues for compensation are to be seen in the context of theories concerning the relationship between speech and gesture. Conversely, developmental studies may need to be more specific about their view of how gestures can serve compensatory functions.

Conclusions and introduction to this issue

The issues regarding language development and gesture raised in this review are far from exhaustive. A range of other questions can be asked, with regard to methodology, to interaction, and concerning the relationship between language, gestures, and culture. Are some types of gesture related to characteristics of the language system while others are more cultural (e.g. gesticulation vs. emblems) and if so, what does that mean for the parallel development of the two modalities? Is there anything in culture-specific communication that affects the emergence and use of gestures, such as the presence of semi-conventionalised, recurrent hand shapes (see Kendon, 2004)? How does lack of contact with a language and culture affect gesture use? Are there differences in gesture practices between tutored and untutored learners? What is the gestural behaviour of early simultaneous bilinguals?

How might learners use gestures to express group affiliation (e.g. Efron, 1972 [1941])? Can language development and gesture be modelled together?

The papers in this special issue span both first and second language development. They all exemplify how studies of language development can gain insights from taking gestures into account. The first two papers focus on first language development. Liszkowski's paper examines the gestures of pre-linguistic infants who have not yet developed their first language. He reviews and assesses what is known about pointing and other representational gestures. The paper re-evaluates current findings and takes a new stance, upgrading the role of pointing and downgrading the role of representational gestures in infants, thereby re-assessing the role of such gestures for the emergence of human communication.

The second paper by Stefanini, Recchia, & Caselli focuses on the relationship between gesture production and spoken lexical capacity in children with Down syndrome compared to typically developing children. Drawing on data from a naming task, the authors show that, although children with Down syndrome do not differ quantitatively in gesture production from developmentally-matched controls, they do differ qualitatively in the distribution of information across the modalities. The study sheds important light on the ways in which gestures come into play when cognitive abilities outstrip productive spoken language skills.

In the transition between first and second language studies, Tellier's paper investigates the popular assumption that gestures improve the acquisition of a new word in a foreign language by looking at French children who are taught English. The study compares the effect of seeing vs. both seeing and producing gestures. The results indicate that (producing) gestures affects the productive retention of new vocabulary. The study thus lends support to the notion that gestures are implicated in learning language specifically, not only learning in general.

In the domain of adult second language development, the paper by Yoshioka examines how adult Dutch learners of Japanese construct narrative discourse in speech and gesture. In particular, the paper investigates how learners deal with crosslinguistic differences in how entities are referred to, for instance by lexical means (e.g. *the frog*, *it*) or by ellipsis. The results show that learners display both general and target language-specific means of structuring information in discourse in the two modalities. In this sense, the study adds to the evidence suggesting that gestures reflect language-specific speech patterns. It also contributes to the study of crosslinguistic influence in SLD.

Brown investigates the interaction between first and second languages in adult speakers, specifically comparing the use of character- and observer-viewpoint in English and Japanese. Japanese speakers with some knowledge of English gesture differently in their native language from Japanese speakers without any knowledge of English, showing patterns similar to those of monolingual English speakers.

Although traditionally only the effect of the L1 on the L2 has been considered in studies of SLD, this paper interestingly suggests that the L2 might also affect the L1. This perspective has important implications for what is considered the native standard in studies of language development.

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Note

1. For an overview of critiques of this hypothesis, see Ellis, 1994, pp. 273–280.

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