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LETTER TO THE EDITOR



Discovering the Role of Gesture in Language and Cognition: An Interview with Dr. Susan Goldin-Meadow

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Dear Editor,

We are honored to present our interview with Professor Dr. Susan Goldin-Meadow, Beardsley Ruml Distinguished Service Professor in the Departments of Psychology and Comparative Human Development at the University of Chicago. This interview is part of the *Interview Series with Experts in Developmental Psychology* initiated by *The Journal of Genetic Psychology: Research and Theory on Human Development*. As part of the journal's commitment to fostering dialogue and collaboration within the developmental psychology community, this series aims to connect emerging scholars with leading figures in the field.

The interview with Professor Goldin-Meadow was a unique opportunity for us, as doctoral students and young researchers, to interact with one of the most influential figures in developmental psychology. During a time of remarkable innovation and discovery, her research offered us valuable insights into the processes of language acquisition and human cognition, especially how gestures influence thought and learning from the earliest stages of development. We are deeply thankful to Dr. Goldin-Meadow for her kindness and generosity in supporting our interview and the preparation of this letter.

Throughout her career, Professor Goldin-Meadow has received numerous accolades for her significant contributions to psychology, including the esteemed *Rumelhart Prize in Cognitive Science* in 2021. Her publications, such as *'The Role of Gesture in Communication and Thinking'* (1999) and *'Language in Mind: Advances in the Study of Language and Thought'* (2003), have been instrumental in advancing research on the connection between gestures and language (Gentner & Goldin-Meadow, 2003; Goldin-Meadow, 1999). Beyond her extensive scientific contributions, Professor Goldin-Meadow is deeply committed to education and mentoring young researchers. She has supervised numerous doctoral students and actively participates in initiatives that promote interdisciplinary research, emphasizing the value of collaboration across disciplines in broadening and deepening our understanding of cognitive and communication processes.

The Relationship Between Language and Gesture from a Neuro-Evolutionary Perspective

Professor Goldin-Meadow's interest in developmental psychology was significantly influenced by her time in Geneva, where she studied with Jean Piaget and Bärbel Inhelder. This formative experience ignited her fascination with cognition and language development. She recounted the

excitement of learning directly from Piaget, describing how his groundbreaking work on conservation influenced her subsequent research. These foundational ideas laid the groundwork for her lifelong exploration of the relationship between gesture and language.

One of the core themes of our discussion was the integration of gesture and speech as a single, integrated communication system (Goldin-Meadow & Alibali, 2013). Professor Goldin-Meadow explained that gestures may convey information that speech alone does not express, creating mismatches—instances where gesture and speech express different ideas. These mismatches offer a unique window into cognitive states in transition (Alibali & Goldin-Meadow, 1993; Perry et al., 1992). She noted that these moments are particularly significant in learning contexts, as they indicate a learner's readiness to acquire new knowledge. This insight has practical applications in education contexts, where identifying mismatches can guide tailored interventions to improve learning outcomes.

In the discussion of the evolution of gesture and language, Professor Goldin-Meadow emphasized the current gaps in our understanding of how gesture and language have been developed together from both behavioral and neurological perspectives. She argued that the relationship between gesture and language would be difficult to explain if they had not co-evolved. Contrary to the view that gesture is a primitive language that later evolved into spoken language, she posited that gesture and language have been an integrated system in human interaction (Iverson & Goldin-Meadow, 2005). As neurological research advances, she believes we will gain deeper insights into the neural mechanisms underlying gestures and language, as well as how their development has evolved over time.

Regarding communication between mothers and their children, significant gaps remain in our understanding of infant-directed speech and children's use of gestures (Bohaček & Cepanec, 2023; Ferguson, 1964). It remains unclear whether parents use gestures more frequently while engaging in infant-directed speech compared to other forms of communication. This is a crucial question to investigate, as increased gesturing in infant-directed speech could affect how often children use gestures themselves, with implications for their language development. In children with brain injuries, parental linguistic input may not necessarily increase; instead, the types of verbal stimulation provided tend to be more directive (Crowe et al., 2014; Wade et al., 2008). This suggests that the nature of linguistic input for children facing neurological challenges can differ significantly, and its effectiveness in fostering language development remains an open question (Thompson & Raikes, 2003).

Future studies might uncover neurological links that clarify how gestures and language interact and shape learning and communication processes (Goldin-Meadow, 2011). To fully understand human communication, it's important to view gestures and language as components of a unified system rather than as separate elements that evolved independently. This integrated approach is crucial for exploring how children use gestures in the early phase of language acquisition.

The Role of Gestures in Typical and Atypical Language Learning

Professor Goldin-Meadow discussed how gestures evolve alongside language during childhood. She emphasized that gestures are intrinsically linked to language, a connection evident even in blind individuals who move their hands while speaking. This suggests that language and gesture form an integrated system in both children and adults (Goldin-Meadow & Singer, 2003; Iverson & Goldin-Meadow, 1997). Early in development, gestures often serve as lexical substitutes before children acquire the linguistic sophistication to integrate them with speech. For instance, children may point at an object while saying a single word, forming rudimentary sentences through gesture-speech combinations (Goldin-Meadow, 2005a, 2005b). Over time, language becomes more integrated with gestures, reflecting an increasing ability to use them as a complementary tool for communication. Professor Goldin-Meadow underscored the importance of studying this transition, as it provides critical insights into the interplay between gesture and language during key stages of development.

While gestures and language can function independently in both children and adults, their roles shift throughout development. In early language acquisition, gestures may serve as stand-ins for words, whereas in adults, gestures typically enhance speech or provide additional information rather than function as stand-alone lexical items (Goldin-Meadow & Butcher, 2003). This suggests that gestures fulfill distinct roles at different developmental stages. As language develops, gestures cease to serve a substitutive function and begin to resemble those produced by adults, conveying more complex, propositional information that is not necessarily tied to specific words. Professor Goldin-Meadow highlighted that gestures do more than accompany spoken language—they also actively contribute to the development of communication skills in children. Understanding how gestures develop alongside language sheds light on the ways children learn and communicate.

Methodological Approach in Developmental Research

Professor Goldin-Meadow shared her research methodology, highlighting the importance of studying a phenomenon in real-world settings before transitioning to laboratory experiments. This process involves carefully observing, describing, and understanding a phenomenon. Once a clear understanding of real-world occurrences is established, the phenomenon can be examined in a laboratory setting for hypothesis testing. She also pointed out that observational studies often provide additional insights that complement experimental research, as illustrated by Carol Dweck's work on mindset theory. Professor Goldin-Meadow mentioned that Dweck and her collaborators conducted foundational laboratory research to understand how different types of praise from adults or experimenters can shape children's perceptions of their intelligence. This research examines whether children view their intelligence as fixed or malleable (Dweck & Leggett, 1988; Mueller & Dweck, 1998). In a follow-up study, Professor Goldin-Meadow, Dr. Dweck, and their colleagues, investigated naturalistic data to assess the kind of praise parents give to their young children. Using longitudinal data, they demonstrated that the type of praise fostering a growth mindset in laboratory settings produced the same effect in a naturalistic study (Gunderson et al., 2013). This hybrid approach, which combines naturalistic observation with laboratory experimentation, facilitates a more thorough exploration of developmental dynamics and enhances theoretical understanding.

Professor Goldin-Meadow underscored the importance of beginning with real world observations, as this approach is particularly productive for identifying real-world problems that can then be studied under controlled laboratory conditions. She emphasized that everyday interactions have a significant impact on cognitive and linguistic development, making it essential for children to be exposed to environments that provide linguistic input to enhance their communication abilities. Moreover, she highlights that most children acquire language regardless of their circumstances, showing a natural predisposition to language acquisition (Goldin-Meadow, 1999). Her research demonstrates that much of language acquisition occurs naturally (Goldin-Meadow & Alibali, 2013). For instance, deaf children with deaf parents can create the foundations of language even without direct exposure to a formal language (Goldin-Meadow, 1993, 2003, 2023; Goldin-Meadow & Mylander, 1990). Rather focusing exclusively on teaching language in isolation, she advocated for helping children use language for practical purposes, such as mathematics or other subjects. This approach integrates language learning with practical skills, making language use more functional and contextual.

The Research on Homesigners

A central focus of Professor Goldin-Meadow's research is homesigners—individuals who create gesture-based communication systems in the absence of access to a conventional language. This phenomenon is observed in deaf children whose hearing losses prevent them from learning

spoken language and whose hearing parents do not know sign language (Goldin-Meadow & Feldman, 1977; Goldin-Meadow & Mylander, 1983). Professor Goldin-Meadow has studied homesigners across various cultures, including the US, China, Turkey, and Nicaragua, to identify linguistic properties that emerge without exposure to conventional linguistic input.

These children develop gestural communication systems that exhibit many features of spoken language, demonstrating how gesture plays a fundamental role in the development of communication (Flaherty & Goldin-Meadow, 2010; Goldin-Meadow et al., 2009; Goldin-Meadow & Mylander, 1998). Professor Goldin-Meadow's research revealed that homesigners produce gestures with linguistic structure even in the absence of formal spoken or sign language, demonstrating the mind's innate ability to organize and express complex ideas through gesture alone (Goldin-Meadow et al., 1994; 2007; Morford & Goldin-Meadow, 1997). She is currently investigating whether the way the hearing parents of homesigners respond to their children's gestures influences their communication, which would suggest that parent-child interaction plays a crucial role in language development.

Investigating Neural Mechanisms of Gesture and Language Integration

When discussing her current projects, Professor Goldin-Meadow shared her team's ongoing efforts to investigate the neural mechanisms underlying gesture and speech integration. Using fNIRS technology, they are exploring how gesture facilitates abstraction and generalization in mathematical problem-solving, building on her earlier behavioral research (Dick et al., 2009; Goldin-Meadow & Brentari, 2017). She expressed her fascination with the neural processes involved when gestures and speech diverge in meaning, believing that these moments of mismatch can shed light on how disparate pieces of information are integrated during learning.

Practical Applications of Gesture in Education and Clinical Settings

Professor Goldin-Meadow's research has profound practical applications. In educational contexts, gestures can serve as powerful tools for both teachers and students. Encouraging students to gesture while explaining concepts can reveal hidden misunderstandings or cognitive states, allowing teachers to tailor their instruction to their students. Moreover, gestures have been shown to enhance learning outcomes in abstract domains such as mathematics, where visual-spatial representation plays a critical role (Goldin-Meadow, 2011). In clinical settings, gestures provide valuable insight into clients' unspoken thoughts and emotions. Discrepancies between speech and gesture may indicate underlying emotional or cognitive conflicts. Professor Goldin-Meadow's research highlights the reciprocal influence between language and cognition. While language shapes thought during active communication, gestures provide evidence of cognitive processes that are not entirely determined by linguistic structures. This duality is particularly evident in her cross-linguistic studies, where silent gestures often reflect universal cognitive patterns, even among speakers of different languages (Goldin-Meadow et al., 2009). This result demonstrates how language and cognition interact in a complex system: language not only expresses thoughts but also shapes them, while gestures reveal aspects of thought that may escape verbal expression alone. This suggests that, regardless of the spoken language, there are common cognitive patterns that manifest through gestures, highlighting a profound connection between how people communicate and think. By recognizing that gestures can convey meaning and reflect cognitive states, we can gain deeper insight into the processes of language acquisition and the ways in which individuals express and organize their thoughts.

Challenges and Future Directions in Psychology and Neuroscience

Finally, we discussed the challenges of using artificial intelligence and machine learning to study gestures. While advances in technology hold promise for automating gesture analysis, Professor

Goldin-Meadow noted that the extraction and interpretation of gestures still rely heavily on human expertise. For example, gestures are often dynamic, even identifying when a gesture starts and when it ends can be difficult.

Conclusion

The interview with Professor Susan Goldin-Meadow was an enriching experience that deepened our understanding of how gestures, language, and cognition are interconnected. Her pioneering research has shown that gestures are not just supplementary to spoken language, but they actively contribute to the communication processes. Professor Goldin-Meadow pointed out that children often use gestures to convey ideas that they cannot yet articulate verbally, highlighting how this form of expression can precede and even predict the new communicative and linguistic abilities (Goldin-Meadow & Alibali, 2013; Goodwyn & Acredolo, 1998). Her findings hold significant implications for both educational and clinical practice. In early childhood education, incorporating gestures in communication could promote more inclusive and effective learning experiences (Freitas & Andrade Neto, 2023). In clinical settings, particularly for individuals with deafness, language disorders, or learning disabilities, understanding how gestures enhance verbal communication opens new possibilities for interventions improving the effectiveness of traditional therapies. For children facing language challenges, gestures can reinforce concept comprehension and aid in spoken language production. Similarly, in cases of deafness, combining gestures with sign language can enhance both communication and learning (Kirk et al., 2015). Parents can leverage gestures to support early language development by responding to their children's gestures and translating them into speech, reinforcing linguistic connections, and fostering richer communication.

The interdisciplinary approach adopted by Professor Goldin-Meadow is crucial for examining complex aspects of human communication from a neuro-evolutionary perspective. Looking forward, future research should explore the role of gestures in the digital environment, providing innovative insights into their interactions with language in technology-mediated settings. The integration of virtual reality and artificial intelligence could enhance our understanding of gestures on a large scale, shedding light on the mechanisms underlying cognitive and linguistic processes (Vasalou et al., 2008; Zhou et al., 2023). We hope that this interview inspires readers of the *Journal of Genetic Psychology* to further explore the role and functions of gestures in developmental trajectories.

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Alice Xu is a PhD student in Developmental Psychology at the University of California, Los Angeles. Her research focuses on STEM teaching and learning, as well as cognitive and language development. She is particularly interested in how learners acquire and apply knowledge in educational settings. Through her work, Alice aims to contribute to the development of effective teaching strategies that enhance learning outcomes in STEM education.

Sara Zanforlini is a Psychologist and PhD student in Educational Sciences and Psychology at the Department of Educational Sciences, Languages, Interculturality, Literatures and Psychology (FORLILPSI) of the University of Florence. Her research interests focus on the study and deepening of the processes that underlie the development of socio-emotional skills, with particular attention to the constructs related to Kindness and school well-being. She

also deals with issues related to illness throughout the lifespan, adopting a person-centered approach and the narration of illness stories.

Dr. Susan Goldin-Meadow is the Beardsley Ruml Distinguished Service Professor in the Departments of Psychology and Comparative Human Development at the University of Chicago. A leading figure in developmental psychology, her research has significantly shaped our understanding of language acquisition, cognition, and the role of gesture in communication and thought. Throughout her distinguished career, Professor Goldin-Meadow has received numerous accolades, including the prestigious Rumelhart Prize in Cognitive Science in 2021. Her influential publications, such as *The Role of Gesture in Communication and Thinking* (1999) and *Language in Mind: Advances in the Study of Language and Thought* (2003), have paved the way for groundbreaking research on the connection between gestures and language development. Beyond her extensive scientific contributions, she is deeply committed to education and mentorship, having supervised numerous doctoral students and actively promoted interdisciplinary research. Through her work, she continues to inspire new generations of scholars to explore the intricate relationship between gesture, cognition, and human development.

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