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While it is possible that despite careful controls the correlation between non-tone languages and *ASPM-D* and *MCPH-D* is just a coincidence, a plausible alternative explanation is that these two genetic variants somehow *cause* languages to be (non-)tonal. However, given that any normal child acquires the language of its community, irrespective of which variant of *ASPM* and *microcephalin* it has, any such causal relationship cannot be deterministic at the level of the individual. Instead, the causal relationship must take the form of a very small bias, whose effects are not manifest during everyday linguistic behavior but become visible only in language change, as language is transmitted across generations over time. The proposal is that in populations with enough individuals biased “against” tone but originally speaking a tone language, each new generation may develop a slightly simplified tone system leading in the end to a non-tone language.

This type of genetically based linguistic bias would allow a better understanding of the biological bases of language and its evolution from our prelinguistic ancestors, as well as deeper reconstructions of past languages. But probably the most important effect would be on the way we conceptualize the complex interactions between culture and biology, helping to move beyond the simplistic and misleading “nature versus nurture” debate toward an integrated view. Not only do genes influence culture, and not only does culture have an impact on genes, but genes *need* culture in order to have any effect in the first place.

D. Robert Ladd and Dan Dediu

See also Language Development; Music and the Evolution of Language; Music Perception

### Further Readings

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## GESTURE AND LANGUAGE PROCESSING

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When people talk, they often gesture with their hands—probably more than they realize. Speakers are generally aware of what they are saying. But when we gesture, we may not know that we’re gesturing, or we may be unaware of the information our gestures contain. Because co-speech gestures are prevalent but often unconscious, they can provide a window into how people think and communicate. This entry describes the basic types of hand gestures that typically accompany speech, provides an overview of their cognitive and communicative functions, and illustrates how gestures vary across languages and cultures.

### Types of Gestures

Gestures vary in form, function, and in how they relate to language. *Emblems* have highly conventionalized forms and stable meanings, much like words in signed or spoken languages. Common emblems include waving the hand to say hello and giving the “thumbs-up” to show approval.

*Iconic* gestures depict some aspect of an object or action and are less conventionalized than emblems. Whereas emblems can be understood independent of language, iconic gestures are often ambiguous without the accompanying speech. A speaker tracing an arc in the air with her fingers could be depicting a rainbow, a dome, the hump of a camel, the flight of a soccer ball, or the rise and fall of a civilization. The latter would be an example of a *metaphoric gesture*, a special kind of iconic gesture that represents an abstract idea. Civilizations cannot literally rise or fall in space, but we talk about them as if they do and gesture accordingly.

*Deictic gestures* refer to objects or locations in physical or conceptual space and often complement deictic language. Telling the clerk at the donut shop that you want *that donut* may not yield the desired

result unless the spoken phrase is combined with a point to the pastry you have your eye on. Deictic gestures can convey aspects of a speaker's meaning that are difficult to express in words.

*Beat gestures*, by contrast, may carry no meaning at all. Speakers frequently make simple motions with the hand or fingers, often repeated, and timed with prosodic peaks in speech. The cognitive and communicative functions of beats are not well understood. Some beats appear to add emphasis to ideas expressed in speech, others to serve discourse functions, and others to reveal the speaker's emotional state: Fast, staccato beats may show agitation; precise beats can show determination or sincerity; large, forceful beats may show either frustration or enthusiasm. The significance of beats can only be interpreted in the context of the gesturer's language, posture, or facial expressions.

Gestures rarely fit neatly into one category or another. Their functions blend and overlap. A gesturer might beat in the rhythm of their speech while pointing or vary the speed or size of an iconic gesture to endow it with metaphorical significance. As such, the gesture types described here should not be considered mutually exclusive. Multifunctional gestures that confound any simple typology are the rule, not the exception.

### Gesturing and Speaking

Why do we gesture when we speak? One reason may be that gesturing helps speakers retrieve words more efficiently, particularly words with spatial meaning. Preventing people from gesturing makes their language production less fluent. Gestures supplement the meaning of speech in at least two ways, *matching* and *mismatching*. If a speaker cups her hand around an imaginary glass while saying *a glass of wine*, this constitutes a match (i.e., overlap) between the content of speech and gesture. If instead, the speaker holds her thumb and forefinger parallel, about an inch apart, to indicate that it was only a small glass of wine, this would constitute a speech-gesture mismatch, because size was not mentioned in the phrase *a glass of wine*. The term *mismatch*, as it is used by gesture researchers, does not necessarily suggest any incongruity between speech and gesture; rather, a mismatching gesture provides information that is not available in the co-occurring speech. Whether matching or mismatching, speech and gesture are never fully redundant. Speech provides a *selective*

*description* and gesture a *selective depiction* of an idea, each highlighting certain aspects. Together, speech and gesture form a composite communicative signal.

### Gesturing and Thinking

But is gesture only for communicating? If so, why do people still gesture when they're on the telephone? In principle, gesturing when nobody can see us could be a vestige of gesturing during face-to-face communication. Yet communicative habits cannot explain why congenitally blind children gesture similarly to sighted children in some contexts, even though they have never seen gestures and have no experience with their communicative function.

Gestures serve cognitive functions for the speaker, independent of their impact on the listener. In classroom settings, gestures can aid learning. More generally, gestures help with tasks that require maintaining or transforming spatial and motoric information in memory.

### Cross-Linguistic Variation in Gesture

The way information is packaged in a language's grammar affects how its speakers gesture. For example, in languages such as English, clauses that describe motion events typically encode information about both the *manner of motion* (e.g., swinging, rolling) and the *trajectory* (e.g., down, across). In other languages, such as Turkish and Japanese, manner and trajectory are packaged into separate clauses. Gestures by speakers of these languages differ accordingly: Speakers of languages that separate manner and trajectory syntactically are more likely to express these aspects of motion events in separate gestures.

Although some emblematic gestures are recognizable across language communities, others are language specific. French and Italian speakers use the "my eye" gesture, pulling down the lower eyelid with the index finger to indicate skepticism about what someone is saying, but this action has no conventional meaning for English speakers. Other gestures have strikingly different meanings across communities. "The horns," made by extending the pinkie and index finger while making a fist, is used to ward off the evil eye in traditional Mediterranean cultures. Variants of this gesture were used in Elizabethan England to accuse a man of having an

unfaithful wife, in modern England and the United States to express a passion for heavy metal music, and in the southern United States to show allegiance to the University of Texas Longhorns sports teams.

Are some gestures universal? NASA carried this assumption to new heights when they affixed a picture of a man showing his open palm to the Pioneer 10 spacecraft, in the hope that this gesture of friendship would be interpretable by any extraterrestrials who should find it.

*Daniel Casasanto*

*See also* Conversation and Dialogue; Multimodal Conversational Systems

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## GROUP DECISION MAKING

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Decisions are often made in groups: sometimes to maximize the quality of the decision, sometimes because the decision makers are all stakeholders, and sometimes to diffuse, or obscure, responsibility. Group decisions range from formal committees to casual conversations, and research has examined the impact on quality, creativity, dedication, and risk tolerance. There are ways in which it is advantageous to have groups involved in decision making. However, in groups, other processes and motivations will often come into play that impair the quality of the decision making. In general, convening a group to make a decision is rarely beneficial, especially when compared to aggregating the same number of independent opinions. The benefits of interaction are not likely to outweigh the costs associated with irrelevant or even counterproductive goals that are added by group settings. There are, however, processes that can minimize such detrimental effects.

### Benefits

Having a group make a decision has various potential benefits. Some of these are quite separate from the quality of the decision itself and include having people feel enfranchised, adding to the credibility of the outcome, and distributing responsibility for the result. However, there is also some notion that the decision itself can be better when it is made by a group. A group is able to include a greater variety of viewpoints and thus summon a wider wealth of knowledge. People's idiosyncratic biases, prejudices, and ignorance can be canceled in the aggregate. Another potential benefit is that people will, in a group, be inspired by those around them, increasing their motivation to do well and seeding their own creativity with the ideas of others. Brainstorming procedures are designed to take advantage of the social interactions, with each person's ideas inspired by and building on the suggestions of others, and the outcome cumulated over the wisdom of each participant. There is evidence that aggregated opinions can be remarkably good in what is sometimes called the *wisdom-of-crowds-effect*, but the way the aggregation occurs is critical in order to avoid the potentially powerful negative effects of group processes.

### Social Comparison Effects

One effect of making a decision as a group is that the individuals do not operate independently of each other, but are motivated to compare their positions to others' and to modify their behavior to manage the impression they make on others. These social comparison processes can have various effects on the decision. One factor that it can alter is the level of risk that is tolerated. This finding, generally called the *risky shift* or, more accurately, the *group polarization phenomenon*, suggests that group discussion will shift the level of risk generally in the direction that is admired. Thus, if the decision concerns sports, for example, where people are inclined to take risks and admire those who do, the group decision will support greater risk than did the average individual. On the other hand, if it concerns the well-being of children, where caution is preferred, the group will adopt a safer strategy than would individuals. At least part of the explanation for this phenomenon and for it working in both directions is that people wish to be slightly better than the average person,