3

Iconicity, Schematicity, and Representation in Gesture

Irene Mittelberg and Jennifer Hinnell

1 Introduction

When human beings communicate with each other, they use their body's natural media – movements of their hands, eyes, eyebrows, mouth, and head, as well as postural shifts – to make meaning. These meaningful expressions of the body are "inseparable" from the spoken or signed signs they accompany (Kendon, 2009, p. 363). The speaker or signer uses them to spontaneously create dynamic physical images of objects and scenes that they have previously experienced or that they are newly imagining. When recounting a story, for instance, speakers may imitate the posture, manual actions, and/or facial expressions of the friend or story character – human or otherwise – that they are talking about. Just as a speaker's hands can represent a physical object, so too can her entire body. For instance, when verbally describing a huge old tree swaying in the wind one might have seen on a walk, one may for a moment actually become the tree by aligning one's legs and torso vertically to portray the trunk and stretching one's arms upward, and swaying from side to side to portray the branches moved by the wind. If, rather than swaying in the wind, the tree had been struck by lightning, one might bend one's torso or arm to indicate the angle at which the trunk now stands. These kinesic, bodily means of communicating human experience and the world around us are examples of the common semiotic practice understood as gesture, in which parts of the speaker/signer's body, most frequently the hands, represent objects or scenes in the space around a speaker's body, or when a speaker's entire body becomes a corporeal icon of something, herself or someone else performing an action or expressing a sentiment (Mittelberg, 2014; Müller, 1998a, 1998b).

According to the US philosopher and semiotician Charles Sanders Peirce (1839–1914), the relationship between the gestures described above and the persons, objects, or scenes they represent is iconic. Iconicity, one of Peirce's

three semiotic modes alongside indexicality and symbolicity rests upon a perceived similarity between the form of a gesture and what it stands for (Peirce, 1955). Peirce defines icons as having "qualities which 'resemble' those of the objects they represent" (Peirce, 1903, CP 2.276)[1]. While the term "icon" might suggest a visual bias, Peirce already had a multimodal understanding of iconicity: something serving as a material sign carrier – like a word or gesture – may look, feel, move, smell, sound, or be structured like something else. In the tree example we began with, iconicity underpins the relationship between the structural and behavioral features of the bodily posture and gestures, on the one hand, and the gesturer's mental representation and perceptual experience of the tree (and the wind going through it) on the other hand. The tree example also demonstrates the abstraction that underlies gestural processes and that results in signs with varying degrees of schematicity. As Arnheim asserts, "[b]y the very nature of the medium of gesture, the representation is highly abstract" (1969, p. 117). In other words, the representation of a living being or an object through the human body is always, as any sign process is, partial, or metonymic (Mittelberg & Waugh, 2014), and conditioned by the affordances and constraints of the medium of the human body and the ways it is possible to move and produce meaningful gestalts. This is not only true of gestural sign formation, but of sign formation in visuo-spatial modalities in general, including in signed languages, which exploit the same bodily means of representing yet have their specific ways of incorporating iconicity into lexicalized signs (Wilcox & Occhino, 2017). The sign in British Sign Language for TREE, shown in Figure 3.1, features a vertically raised arm with thumb and fingers outstretched and the other arm horizontally and contiguous with the upwards-stretched arm providing the "ground" on which the tree is situated (see Taub [2000], in which the American Sign Language (ASL) sign for TREE is the basis for her account of abstraction and schematization in ASL; see also Section 3.2 below). The lexicalized image icon of TREE "both

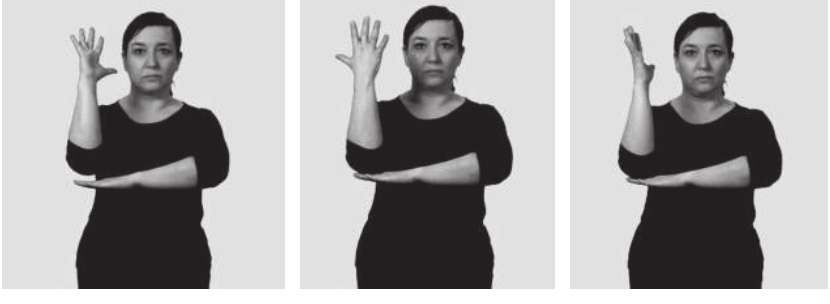

Figure 3.1 Sign for TREE in British Sign Language (Fenlon et al., 2014; used with permission of the BSL Signbank)[2]

[1] Reference to Peirce's papers will be designated CP for *Collected Papers* (Peirce (1866–1913/1931–58) followed by volume and paragraph number. The year denotes the publication year of the paper.

[2] Accessed at https://bslsignbank.ucl.ac.uk/dictionary/words/tree-1.html on August 9, 2022.

preserves the structure of the image and fits the phonotactic constraints of the language" (Taub, 2000 p. 34).

Iconicity is not relegated only to visuo-spatial languages but rather is a property that motivates language structure regardless of the mode of communication (e.g. manual signs, spoken forms, and written forms) (e.g. Hodge & Ferrara, 2022; Nielsen & Dingemanse, 2021; Perniss, Thompson, & Vigliocco, 2010). While these recent works demonstrate a resurgence in the study of iconicity as a language-general property over the last decade, studies from a range of approaches in the previous half-century demonstrate the iconic grounding of structures in spoken language. For instance, phonological and morphological structure (Jakobson, 1966), the lexicon (Waugh, 1992), and syntax (Haiman, 1985, 2008) have been shown to be motivated by perceptual and structural similarity. (For recent work on iconically motivated structures, see e.g. Devylder's [2018] account of possessive constructions in the Paamese language of Vanuatu.)

Leaving iconicity in other language structures aside, this chapter presents an overview of the fundamental role iconicity plays in the formation and interpretation of co-speech gestures. Iconic and representational aspects of communicative body postures and hand movements, which have always been a central issue in gesture research (e.g. McNeill, 1992; for overviews see Hodge & Ferrara, 2022; Mittelberg & Evola, 2014), typically have a close semantic relationship with the propositional content of the verbal utterance they occur with (Kendon, 2004; Kita, 2000). Iconic gestures (which McNeill [1992] terms *iconics*, Müller [1998a] calls *referential,* and Kendon [2004] and Streeck [2009] call *depictive* gestures) are broadly understood as manual gestures and body postures that represent concrete objects and actions, as in the examples given above. However, iconicity plays a far greater and more complex role in gestural communication beyond simple resemblance relations and concrete content. In this chapter, we introduce the role of iconicity as a motivating ground for gesture formation, moving beyond a narrow definition to introduce the workings of representation in gesture more broadly.

To provide a theoretical foundation for the various modality-specific manifestations of iconicity in gesture that we will discuss in this chapter, we draw on Peircean semiotics and cognitive linguistic accounts of how iconicity is inherent to embodied conceptual and linguistic structures (e.g. Lakoff & Johnson, 1999; Taub 2000, 2001; Wilcox, 2004). Peircean semiotics and cognitive linguistics recognize that repeated, similar experiences with the physical and social world are at the root of embodied patterns of sensing, acting, thinking, and communicating (e.g. Danaher, 1998; Mittelberg, 2008, 2019a, 2019b), and both approaches consider how these patterns play out in multiple modalities and sign systems. Building on these premises, we present different kinds and degrees of iconicity observable in gesture. The chapter is structured as follows: We first lay out the semiotic foundations of representation and iconicity, established by Peirce, including diagrammatic and metaphor iconicity, and apply them to gesture, while also discussing the role of

abstraction, metonymy, and viewpoint (Section 2). In Section 3, we first clarify terminological issues in this area and then provide an overview of recent foundational approaches to iconicity and representation in gesture studies as well as a survey of the techniques speakers use to create gestural signs. In Section 4 we highlight recently applied and empirical research, and we close with final thoughts in Section 5.

2 Semiotic Foundations of Iconicity and Representation in Gesture

Largely since the 1980s, but aligned with earlier semiotic theories as well (e.g. those of Peirce and Jakobson), language has been shown to be situationally grounded and multimodal. That is, the multisensorial experience of humans as embodied beings in the world is a motivating factor in linguistic structure, conceptual knowledge, and language use (Gibbs, 2005). Human communication – particularly in the visuo-spatial modality of gesture and signed languages – is thus understood as being rooted in embodied patterns of experience and expression (e.g. Janzen & Shaffer, 2022; Perniss & Vigliocco, 2014). Building on Peirce's well-known assertion that "we think only in signs" (Peirce, c.1895, CP 2.302), in this chapter, we are particularly interested in how speakers embody salient facets of their thinking, remembering, and imagining in gestural signs, and how their interlocutors interpret and understand bodily expressed meanings in the context of multimodal interaction. We start with Peirce's model of the sign and what it can explain about gestural signs.

2.1 Peirce's Sign Model and the Triad Icon–Index–Symbol

To understand iconicity, we first grapple with the notion of "sign" as defined by Peirce (c.1897, CP 2.228), who used the term *representamen* to mean "something which stands to somebody for something in some respect or capacity." A representamen is a material sign carrier, for example, a spoken word, a sign in a sign language, or a gesture, such as in the tree gesture described earlier. When perceived by an addressee, the representamen creates an "equivalent sign, or perhaps a more developed sign," the *interpretant* of the original sign (Peirce, c.1897, CP 2.228). The interpretant is the cognitive response that is evoked in the mind of the person interpreting the sign, thus linking the representamen with what it is taken to stand for, the *object*. Semiotic objects encompass physical objects and actions as well as abstract notions and affective states, including concepts, relations, qualities, and feelings, and so on, or anything that can be represented by a sign. The affordances of the body determine in part what can be gesturally represented as an object, and how it is represented (Mittelberg & Hinnell, 2022). Some objects can be genuinely portrayed by the hands and body: For example, actions the hands

routinely do – such as opening or closing a door – are easily enacted in iconic gestures. Larger objects that one normally cannot hold in one's hands, such as a city skyline, need to be brought down to a much smaller scale to be iconically depicted in gesture, and other objects simply do not lend themselves so freely to depicting via gesture, for example, colors. Finally, Peirce's model of the sign describes the *Ground* of a representamen as the relevant aspect that it foregrounds in the object. Iconic grounds imply that an object is not represented in all its aspects but in partial and abstracted ways (Peirce, c.1897: CP 2.228; Sonesson, 2014; see Section 2.3 on metonymy). In both gestural sign formation, or production, and sign interpretation, or processing, the three basic semiotic relations intertwine: similarity (iconicity), contiguity (indexicality), and conventionality (symbolicity), with one of them being predominant and thus determining the gesture's primary function (Peirce, 1893: CP 2.275; e.g. Enfield, 2011; Fricke, 2012; Mittelberg, 2013).

While this chapter focuses on iconicity and representation in gesture, before moving on, we briefly introduce the other two main sign relations proposed by Peirce to better understand what characterizes iconic signs and how iconic dimensions interact with other semiotic modes in the gestural modality (for a more detailed account, see Mittelberg & Hinnell, 2002). *Indexicality* is often taken in gesture studies to be synonymous with pointing gestures (Fricke, 2007, this volume; McNeill, 1992). Points create a relation between the tip of the articulator – the finger or hand depending on the hand shape, or even nose in the case of nose points (Cooperrider & Núñez, 2012) – and the target, real or imagined, of the pointing. The third relation between representamen and object is *symbolic*. For Peirce, symbolic signs are primarily rooted in *conventionality* and habit (e.g. Peirce, 1902, CP 2.170) but not necessarily in arbitrariness, as posited by Saussure (1916/1986) regarding linguistic signs. Emblems, such as the thumb up gesture signaling approval, are truly symbolic signs in which conventionality is usually afforded by sociocultural conventions (e.g. Calbris, 1990; McNeill, 1992). The Peircean idea of *habit* is particularly suited when considering the gradually routinized correlations between recurring gestural forms, their action origins, and schematic meanings (Mittelberg, 2019b). Examples include the frequent use of certain gestural forms in a given context as in the case of recurrent gestures – such as the cyclic gesture (Ladewig, 2011) – which can fulfill various conventionalized pragmatic functions (e.g. Bressem & Müller, 2014a). (See also Ladewig, this volume, on recurrent gestures.)

2.2 Subtypes of Iconicity: Image–Diagram–Metaphor

To further characterize iconic signs, Peirce distinguished three subtypes of icons (Peirce, 1903, CP 2.276) – *images, diagrams,* and *metaphors*. With regard to gesture, *image iconicity* captures depictive gestures, for example, portraying the salient features of an object, as in the tree example above, or of the actions of a character (animate or inanimate). The degree of iconic

substance can vary. For instance, Bouvet (1997) gives the example of a child "becoming" a helicopter, with his torso becoming the body of the helicopter and his arms representing the rotating blades. Whole-body enactments like this one, or the tree mentioned earlier, show a more iconic form than if an object (or motion) – such as the shape of a tall building or the winding path of a mountain trail – is briefly outlined in the air.

Diagrammatic icons in gesture are those that exhibit connections between two or more locations in gesture space. Rather than resembling their object as image icons do, diagrams are more aptly recognized as schematic spatial representations of relations between items (Peirce, c.1897: CP 2.228). For example, in motion-capture renderings of a speaker describing a travel itinerary by sketching out the path linking several destinations in gesture space, the movement trace becomes a digital, iconic sign of a diagrammatic gesture (see Mittelberg & Rekittke, 2021). Diagrammatic iconicity has been shown to underpin, among other things: tree diagrams illustrating kinship relations (Enfield, 2009; Gaby, 2016) or syntactic structures (Mittelberg, 2008); gestures that accompany contrastive expressions in speech (Hinnell, 2019); and specific visuo-spatial signs, for example, the sign in Auslan (Australian Sign Language) POLICE CATCH THIEF, which "mirrors both the spatial and agentive relations between policeman and thief" (Hodge & Ferrara, 2022, p. 4; Johnston, 1996).

In gesture, *metaphor iconicity* captures representations in which a comparison underlies the gestural image (Peirce, c.1897, CP 2.228; see also Mittelberg, 2008, 2014). For example, in her study on aspect-marking gestures, Hinnell (2018) showed a gesture accompanying the utterance "that jackpot keeps getting higher and higher," as shown in Figure 3.2. The gesture features both hands in a flat, outstretched form, facing the body, and moving over each other one after the other to form an upward-moving rotation. The gesture form moving upward is underpinned by the image schemas PATH, CYCLE, and VERTICALITY (Johnson, 1987) and the correlated conceptual metaphor MORE IS UP (Lakoff & Johnson, 1980), that is, the more of something there is, the higher it can pile up. The increase in the "jackpot" (an abstract amount of money) motivates the repeated upward-moving arm movements, which effectively parallel the linguistic iconic reduplication "higher and higher."

Other examples of metaphor iconicity include a schematic gesture that very naturally accompanies the spoken utterance describing a speaker's habit of watching a sitcom series, "from where I was till like the end of the season," in which the gesture manifests as a horizontal, relatively straight motion of the right hand moving from the speaker's left to right. This gesture inherits its form and meaning in part from the embodied image schema SOURCE-PATH-GOAL and the conceptual metaphor TIME IS SPACE (for a more detailed analysis see Mittelberg, 2018). Other metaphoric gestures involve gesturing hands that seem to be describing or handling physical objects while the speaker is talking about abstract notions (e.g. Cienki & Müller, 2008; Müller, 2004), such as moral values (Cienki, 1998) and grammatical categories (Mittelberg,

Utterance: *So when there is no winner, that jackpot keeps getting higher and higher* (underlined segment is gestured).

Gesture: upward moving bimanual spiral gesture with six iterated phases.

Scan QR code with your mobile device to see video (published online under Fair Use).

Figure 3.2 Gesture motivated by MORE IS UP conceptual metaphor in "jackpot keeps getting higher and higher" (Hinnell, 2018)

2008; Streeck, 2009). These invoke the OBJECT image schema and relatedly the IDEAS ARE OBJECTS metaphor (Lakoff & Johnson, 1980). Gestures thus show a tendency to physically embody aspects of the source domain of a metaphorical construal (e.g. Müller, 2017).

Metaphor iconicity also motivates, at least in part, many gesture forms associated with pragmatic and recurrent gestures. For example, the Holding Away gesture (Bressem & Müller, 2014b; Bressem, Stein, & Wegener, 2017), which features a hand oriented vertically and facing away from the body, represents a physical barrier that the speaker places between herself and her interlocutor. In this case, the hand functions as a barrier as if stopping a physical object (via image iconicity reflecting the image schema BARRIER); but for the barrier to be meaningful as a Holding Away gesture in a discourse context between two speakers, there is metaphoric iconicity that holds as well, rooted in the metaphor COMMUNICATION IS OBJECT TRANSFER (Lakoff & Johnson, 1980). Thus, the barrier is erected (i.e., the speaker's hand is raised) to ward off an incoming discourse object from the interlocutor (hence it is also called a "fend off" gesture; Wehling, 2017), which also allows the speaker to hold the floor. In the examples in Figure 3.3 from a multimodal corpus study (Hinnell, 2020), each speaker utters the discourse juncture *but anyways* while at the same time gesturing a fending off or Holding Away gesture. The speaker buys herself time to shift topics, while at the same time preventing her interlocutor from interrupting and claiming the floor. While this gesture exhibits schematic iconicity of a barrier, there is no direct semantic relation between this gesture's form and the speech content; the gestural action thus *does* something in its own right.

While gesture analysis typically involves categorizing gestural signs, for example, by identifying all iconic or metaphoric gestures in a data set, gesture scholars have recognized the need to consider semiotic dimensions,

Figure 3.3 Metaphor iconicity in Holding Away gestures with "but anyways"

rather than gesture categories, to do justice to the gradient multifunctionality observed in many gestures (e.g. Enfield, 2011; Kendon, 2004; McNeill, 2005; Müller, 1998b). Indeed, especially when following Peirce (e.g. c.1895: CP 2.302), the different semiotic relations – notably, iconicity, indexicality, metaphoricity, and conventionality – can only be seen as interacting in a given gestural sign alongside other features of the multimodal context in determining the locally predominant function of a specific gesture (see Mittelberg, 2008, 2013). Under this hierarchized view of semiotic layering, it is evident that predominantly symbolic signs actually often incorporate indexical and/or iconic dimensions. For example, a conventionalized "come here," or beckoning, gesture, combines all three meaning relations: It simultaneously "points" toward the intended recipient (indexical); it represents the path between the gesturer and the recipient (iconic); and it is conventionalized in cultures (symbolic): for example, in the USA, people beckon with the palm up, whereas in Mexico, speakers beckon with the palm down (Cooperrider & Goldin-Meadow, 2017, p. 121). Another basic cognitive-semiotic principle that is also involved in the gestural sign processes described so far is metonymy, to which we now turn.

2.3 Abstraction, Metonymy, and Viewpoint in Gestural Signs

The complex relationship between gestural representation and the speakers' inner and outer world largely rests in the experientially motivated, schematic, and metonymic nature of iconic and metaphoric gestures. In this section, we explore processes of abstraction and metonymy in gestural signs and how these interact with the expression of viewpoint.

Gestures are by nature abstract(ed) and partial representations (Arnheim, 1969; Kendon, 2004; Müller 1998b; Streeck, 2009) and thus inherently metonymic (Mittelberg, 2019a). As illustrated earlier in this chapter, and likely intuitively known to the reader, only certain – for example, prototypical or locally relevant – aspects of a particular object or action are highlighted in the creation of an iconic and/or metaphoric gesture; other implied aspects often need to be completed, imagined, or otherwise inferred by the interpreting

embodied mind. As emphasized by Streeck, rather than copying abstracted features, gestures are "tools that enable and accomplish the abstractions" (2009, p. 120), for example, abstracting path from motion events (p. 133). In the Introduction to this chapter, we gave the example of a tree swaying in the wind that one has seen on a walk. In that example, the whole-body gestural icon of a tree necessarily involves an abstraction from the specific, fully fledged tree that was seen, with its idiosyncratic shape, distinctive bark, leaves, and color, and how the scene was experienced multisensorially by feeling and hearing the wind moving the leaves and branches. Similarly, the lexical BSL sign TREE in Figure 3.1 (and, as Taub [2000] notes, for the sign TREE in ASL), this fully conventionalized sign is highly abstracted and schematized, losing many details: The five outstretched digits do not represent the number of branches in a specific tree, for example, nor does the pivoting action of the arm and hand represent the precise degree of swaying of the leaves of the tree in question.

In addition to such fully coded iconic signs, signed discourse often comprises iconic gestural elements exhibiting spontaneous abstraction and modification (Liddell, 2003; Perniss, Özyürek, & Morgan, 2015). Conversely, iconic and metaphoric gestures may reflect sedimented abstraction processes leading to rather schematic imagery with schematic meanings and pragmatic functions, as we saw in the barrier example (Hinnell, 2020; Mittelberg, 2019b). As emphasized by Mittelberg (2019a), metonymy is one of the central forces leading to the emergence of such strongly habitualized hand shapes and movement routines with retraceable action-based motivations, which are, to a certain extent, reminiscent of semantic bleaching and grammaticalization processes in language (Hopper & Traugott, 2003; Janzen & Shaffer, 2002). For example, Mittelberg (2017) has suggested that the manual action of giving is the experiential substrate of (palm up open hand [PUOH]) gestures that are observed with the German intransitive existential construction *es gibt*, translated as "there is/are" rather than as a ditransitive "give" (*geben*) verb. In such multimodally instantiated constructions, routinized gestures metonymically enact "reduced and more schematic variants of the full action of giving," in which "the act of giving is reduced to an act of unimanual holding that exhibits a decreased degree of transitivity and iconicity, thus evoking, for instance, a scene of existence, or presence, rather than a scene of object transfer" (Mittelberg, 2017, p. 14).

Beyond structural and behavioral similarity, as highlighted in the tree example, metonymic abstraction in gesture (and sign language) further exploits contiguity relations that can be observed between the gesturer's body and its environment (Mittelberg, 2013). Contiguity encompasses factual connections such as physical impact, contact, adjacency, but also spatial and temporal proximity or distance (Peirce, 1901: CP 2.306). Gestures naturally (re)establish contiguity relations that occur between hands and the material world they habitually get in touch with, for example, by holding, moving, or otherwise manipulating objects, tools, technical devices, and other artifacts.

Examples include cases where speakers pretend to be holding and showing what they are talking about by either seemingly holding an imagined object with both hands or presenting something on an open palm (contact, adjacency). In the study mentioned above, a speaker made a PUOH gesture when saying in German that *es gab ja die Analogie zur Musik* ("there was the analogy to music"; Mittelberg, 2017, p. 7). The speech content draws attention to an invisible object (the analogy) which needs to be inferred from the visible open palm. Although the gestural enactment stems from a physical action, it is not iconic of the meaning conveyed in speech. Rather, the gesture contributes to the overall meaning of this multimodal performance by metonymically alluding to an imagined contiguous physical object that metaphorically stands for an abstract entity (Section 2.2). In the interpretation of multimodal metaphor, metonymy may thus lead the way into metaphor (Mittelberg & Waugh, 2009; see Mittelberg & Waugh, 2014, on contiguity relations and ensuing distinct metonymic modes [Jakobson & Pomorska, 1983] in gesture).

The meaning of iconic and metaphoric gestures may also be anchored in a metonymic portrayal that activates a larger pragmatic context. If a speaker communicates to a colleague, for instance, that she will send her a message by raising her hands as if typing on an imagined keyboard, the observer does not expect, nor require, the gesturer to also gesture the keyboard itself in order to understand that the message is typed on a keyboard. The observer would also infer, then, that the speaker will be sitting at a desk, for example, typing at a computer. By dynamically abstracting salient characteristics, a quick gestural action, such as the typing hands, can metonymically evoke not only the fully performed action of hitting particular keys, but associated actions, persons, purposes, results, and mental states as well – aspects that are "metonymically linked in a pragmatically structured context of experience, or frame (Fillmore 1982)" (Mittelberg, 2019a, p. 2). Iconic gestures can thus "trigger an ensuing associative chain and a larger semantic network" (Mittelberg, 2019a). These inferential processes involving metonymy rest upon what Langacker (1993) calls reference-point phenomena, as highlighted by Cienki (2017) and Mittelberg (2019a).

Last, the partial and thus metonymic construal of discourse contents is also conditioned by a particular viewpoint. Iconic gestures, especially, tend to be shaped by one of the viewpoint strategies speakers typically adopt when recounting, for example, a scene they witnessed first-hand or saw in an animated cartoon (McNeill, 1992): *character viewpoint* by enacting their own previous behavior or the actions of another person or character; *observer viewpoint* by singling out, for instance, the motion path of a character; or *dual viewpoint* by combining the two, for example, imitating the body posture of a person walking up a hill while drawing the path he took in the air (e.g. Parrill, 2009; Sweetser, 2012). Given the kinesic affordances of the speaker, or signer, being able to employ several bodily articulators simultaneously (a characteristic that is very different from the more linear nature of speech), they can also impersonate two people at the same time, for example, by miming the manual

actions of one person and the facial expressions of another (see Dudis, 2004, on *body partitioning* in ASL). Gestures and signs thus allow us to represent different construals of the same experience by expressing multiple viewpoints (Stec, 2012; Sweetser, 2023).

Having provided a basic semiotic characterization of co-speech gestures, and particularly of predominantly iconic and metaphoric gestures, we will now review various foundational perspectives on how these kinds of bodily signs contribute to multimodal meaning-making.

3 Perspectives on Gestural Representation, Iconicity, and Sign Formation

This section presents an overview of some of the prominent views on representation and iconicity in gesture, including gestural practices of sign formation. Before continuing our exposition, it seems useful to address some terminological issues, as the terms "representation" and "reference" are sometimes employed inconsistently in the gesture literature. It is outside the scope of this chapter to fully treat these complex questions; below, we provide some first points of orientation.

3.1 Terminological Considerations

As introduced above, in Peircean semiotics, iconic signs (and not only iconic ones) serve purposes of *representation*. With an iconic gestural form, a speaker may represent – that is, depict, portray, enact, imitate, mime, illustrate, demonstrate, or sketch – facets of her outer and inner world of experience in a subjective fashion. She can, for instance, depict a physical object that she has held in her hands many times, for example, her favorite cup; but she may also use an iconic gestural description of the shape of a (not yet existing) dress she is planning to design herself. In cognitive (and cognitive-linguistic) accounts of how meaning arises from multimodal descriptions, the idea of a *mental representation* of the objects being described is central and combines concepts and embodied schemata of multisensorial experience (see Section 2.2). Iconic (and metaphoric) gestures are assumed to actively partake in processes of conceptualization and imagination (see Sections 3 and 4).

Another way the term "representation" is used concerns semiotic practices of gestural sign formation. Such *modes* or *techniques of representation* reflect the different ways in which the hands and other body parts can create iconic signs (Müller, 2014). Each mode determines how a gestural form depicts an object and/or action, for example, what features are actually "picked out" and represented in a given gesture (see Section 3.3).

Reference is also a relevant notion here. In McNeill's original classification (1992) and in subsequent widespread use in psychological studies, representational gestures (comprising iconics and metaphorics) and deictic gestures have been grouped together as "referring" or *referential* gestures, that is, relating to

the referential content in speech. Here we highlight the problems that come with this broad grouping to show the necessity of a deeper understanding of the semiotic processes we introduce in this chapter. In brief, as opposed to most iconic gestural signs, deictic gestures typically do not depict their referent, but rather point at it; they refer, for example, to something by indicating a referent in space. In these cases, the referent may be an actual physical object in the immediate material environment, such as a chair, but also a mountain range in the far distance, or a location in gesture space (Fricke, 2007, this volume; and McNeill, Cassell, & Levy, 1993). So, importantly, such highly indexical gestures – which are primarily based on contiguity and not on similarity – usually do not represent content (but see Hassemer & McLeary, 2018).

Looking closely at the intricate mechanisms of representation and reference allows us to better understand the very nature of gesture. Importantly, gestures have, as compared to words, a different, namely dynamic, three-dimensional visuo-spatial modality and can thus establish different kinds of semiotic relationships to what the speaker is talking about; or even produce additional iconic structure as in the barrier example discussed earlier. Gestures thus show a natural propensity to create iconic (and indexical) grounds with a broad array of both static and dynamic phenomena (e.g. Mittelberg & Waugh, 2014). Furthermore, although gestural signs may exhibit advanced degrees of conventionalization, the way they signify is, for the most part, not based on highly coded form–meaning relationships that typically underpin reference in spoken and signed languages (e.g. Sweetser, 2009; see also Sandler, Gullberg, & Padden, 2019, on "visual language"). The terms "referent" and "referential gestures" are notably used in linguistic accounts of gesture (e.g. Calbris, 1990; Müller, 1998b); as in linguistics, one speaks of a referent of a word as the concept denoted by the word, which may or may not imply a physical referent object situated in the extralinguistic context.

Some scholars have come to question the idea of representation and reference in gesture, for example, suggesting that a gesture is often what it is taken to be about (McNeill, 2005; Merleau-Ponty, 1962; Mittelberg 2019a, 2019b) and/or emphasizing the role of *enaction* in sense-making (e.g. Di Paolo, Cuffari, & De Jaegher, 2018). Having discussed basic terminological aspects, we now turn to a brief overview of some of the foundational contributions toward the study of gestural iconicity and representation in recent decades.

3.2 Proposals on Representation and Iconicity in Gesture

In this section, we introduce the main tenets of influential proposals on representation and iconicity in gesture over the last 30 years. For more detail, including historical synopses, see, for example, Bressem (2013), Kendon (2004), Mittelberg & Evola (2014), Müller (1998b), and Müller, Ladewig, & Bressem (2013); see Hodge & Ferrara (2022) for a recent overview.

One of the most commonly referred to typologies in current gesture studies, especially in psychology and psycholinguistic approaches, is David McNeill's (1992) Peirce-inspired characterization of gesture types that describes *iconic*

gestures as gestures that represent relevant aspects of the meaning, conveyed in the concurrent speech, that relate to physical entities and actions. These relevant aspects may be illustrated through an isomorphic correspondence (Kita, 2000, p. 162) between gesture hand shape, trajectory, or some quality of the movement and the action, motion, person, or object that it represents. McNeill's typology further distinguishes between the concrete and abstract natures of the entity being represented: *Iconics* represent a concrete object or action and *metaphorics* are those in which the visuo-spatial form presents an abstract notion, such as "knowledge, language itself, the genre of the narrative, etc." (McNeill, 1992, p. 80). For McNeill, iconic and metaphoric gestures are representational gestures, while *deictics* (pointing) and *beats* (rhythmic) are not. He further illuminates the viewpointed nature of iconic gestures, distinguishing between *character, observer,* and *dual viewpoint* (McNeill 1992, 2005; Parrill, 2009; Sweetser, 2012; see Section 2.3 for more details).

Linguistic anthropologist Adam Kendon (2004) focused heavily on how individual and recurrent gesture forms, such as gesture families, become meaningful in their specific, culturally shaped contexts-of-use. Within the referential function of gesture, or what he called "visual action," he delineates gestures that "provide a *representation* of an aspect of the content of an utterance" (p. 160, italics in original) and those gestures that contribute to the content of an utterance by pointing to an object of reference (deictic gestures). In dealing with representational gestures, he seeks to understand the techniques that are used to achieve representation (see Section 3.3) as well as the different contributions that representational gestures make to utterance meaning.

Geneviève Calbris was one of the earliest modern scholars to discuss matters of convention in representational gestures. In her description of *mimic representation*, Calbris (1990) examined how mimetic gestures can reproduce the shape and dimensions of an object, the way an object is handled or used, or the operation of an object. She emphasized that – regardless of their motivated, and hence iconic, nature – mimetic gestures always also integrate conventional dimensions in the sense that they reflect cognitive schemata or culturally engrained practices. For example, a French speaker's gesture for calling someone on the phone conventionally involves a single hand as if holding the phone as an instrument up against one's ear. Calbris pointed out that, in the days of rotary phones at least, in Italy, Neapolitans gestured the act of calling someone by miming the dialing of the number on a phone in front of them with small circular movements. Thus, she observed cultural differences not only regarding which features of a scene or a reference object get selected and then encoded for representation in the gestural modality but also how exactly a gesturer might mimic an action. Finally, Calbris also elaborated the schematicity of certain mimetic gestures resulting from the "powers of abstraction. [...] Even in evoking a concrete situation, a gesture does not

reproduce the concrete action, but the idea abstracted from the concrete reality" (Calbris, 1990, p. 115; Calbris, 2011; Calbris & Copple, this volume).

In Cornelia Müller's multifaceted research related to representation and gesture, she distinguishes between referential gestures denoting concrete entities from those denoting abstract entities (Müller, 1998b, p. 113). Her work on metaphor in gesture has shown that gestures have the capacity to activate, or awaken, conventionalized images and other aspects of underlying metaphorical construals, thus portraying their dynamic dimensions (e.g. Müller 2017). Adopting Bühler's (1934 [1984]) Organon model of communication to multimodal interaction, Müller highlights that in gesture, too, the three sign functions proposed by Bühler – the *representing* (content-oriented), *expressive* (speaker-oriented), and *appellative* (interlocutor-oriented) function – typically interact to varying degrees (Müller, 1998b, p. 104; 2014). Müller further elaborates how gestures are forms of visual and manual thinking that are shaped by different "modes of gestural representation" (Müller, 1998a, 1998b, 2014, this volume) which are the focus of Section 3.3 on iconic sign creation.

A characteristic of gestural representation emphasized by many scholars is polysemy. Due to gestures' schematic and partial way of representing or enacting (Section 2.3), a single gesture form is potentially polysemous in that it may create iconic relationships with different referents, thus taking on different, including metaphoric meanings (e.g. Calbris, 2011; Cienki, 1998; Mittelberg, 2008). For example, in a certain discourse context, an arm and hand placed horizontally in front of the speaker's body, with the flat hand facing downwards, may represent a rug the speaker is talking about, whereas the same gesture form in another speech context might represent more abstractly the flatness of a specific desert's topography (Kendon, 2004, p. 160). In both cases, the gesture represents certain aspects of the propositional content of the utterance, which explains why iconic gestures have also been referred to as *content gestures* – as opposed to *interactive gestures* (Bavelas, Chovil, Lawrie, & Wade, 1992). Hence, it is often not evident what iconic gestures represent when focusing on their formal features and not considering the concurrent linguistic signs and other contextual factors (which is often a first step in gesture analysis; see Müller, this volume).

In this section, we have provided a brief synopsis of key elements in recent approaches to iconicity and representation in gesture. Beyond those mentioned here, other seminal scholars describe phenomena of representation but prefer to avoid the concept of iconicity. Streeck, for example, has a point in arguing that "representation actively organizes the world," rather than simply "looking like" or "being like" something in the world (2009, p. 119). We now turn our attention to semiotic practices of gestural sign formation and thus to how gestures may reflect, construe, and also create facets of the interlocutors' material, social, semiotic, and imaginative worlds for communicative purposes.

3.3 Modes and Techniques of Gestural Sign Formation

The ways in which gestures are formed have been investigated by many scholars already mentioned here (e.g. Calbris, 1990, 2011; Kendon, 2004; Müller, 1998a, 1998b, 2014; Streeck, 2009) as well as earlier ones (e.g. Ekman & Friesen, 1969; Mandel, 1977; Wundt, 1973). Their respective classification systems all attempt to distinguish a variety of different *techniques* or *mode*s of *representation* or *depiction*. Here we explore these distinctions, largely according to Kendon, Müller, and Streeck's work (see also Clark, 2016, on depiction, and Ferrara & Hodge, 2018, for a recent overview).

Kendon highlights several ways in which a gesture "may provide a *representation* of an aspect of the content of an utterance" (2004, p. 160): *modeling, enacting,* and *depicting*. In modeling, a body part is used as a model for some object, for example, a hand takes a form that "bears a relationship to the shape of the object the gesture refers to" (p. 160). Enacting, or pantomime, involves gesturing body parts that "engage in a pattern of action that has features in common with some actual pattern of action that is being referred to," while in the depicting mode the gesturing hands (or other body parts) "'create' an object in the air" through sculpting or sketching, for example (Kendon, 2004, p. 160).

Müller's original classification (1998a, p. 123; 1998b, p. 323) introduced four modes of representation in gesture, namely *drawing* (e.g. tracing the oval shape of a picture frame), *molding* (e.g. as if sculpting the form of a crown); *acting* (e.g. pretending to open a window), and *representing* (e.g. a flat open hand standing for a piece of paper). She later suggested that techniques of representation can be boiled down to two fundamental modes: "In the acting mode, the hand(s) re-enact(s) any kind of action or any kind of movements of the hand. In the representing mode, the hand(s) turn(s) into a manual sculpture of an object" (2014, p. 1696). For Müller, the "acting" mode consists of enacting action and enacting motion. Enacting action is further differentiated for the presence, absence, and specification of an object (or not). For example, enacting action with no object could consist of waving or walking; enacting action with a specific object could represent turning a key; and enacting action with an unspecified object could involve presenting a "discourse object" with a PUOH gesture (Müller, 2004). Acting also includes enacting motion only or depicting motion as well as path and/or manner of motion (as in "rolling down"). Within the representing mode, Müller distinguishes representing objects and representing objects in motion (Müller, 2014, p. 1697; see also Müller, this volume).

For Streeck (2009), depiction is but one of the six *gesture ecologies* he identifies as "ways in which gestural activity can be aligned with the world" (p. 8). Within depiction, he specifies a range of different practices that begin to explain how gestures can "depict, analyze, and evoke the world" (p. 120). He describes the depiction of real and fictive motion, for example, a gesture showing the path of a car in motion and a gesture showing a cliff "falling off to your left," respectively, the latter of which is actually a dynamic gesture

depicting a static feature in the world (Streeck, 2009, p. 134). The technique of drawing enables the viewer to see a gestural trace left by a moving hand or finger, while handling involves a schematization through gesture of a practical action in the world, expressing a relationship between the speaker's body and an object that the body normally handles, such as transporting (picking up, putting down) and grasping objects. Streeck's notion of *ceiving* captures a more self-absorbed way of finding a gestural image for an emerging idea: "When 'they think with their hands', speakers rely on their bodies to provide conceptual structure" (Streeck, 2009, p. 152). Speakers can also incorporate parts of their environment in which the narrative setting is depicted, which he calls "indexing," or "projective indexing" when it projects these marks onto oneself, for example, when a speaker brings her hands to her own hair when referring to someone's "blond angel hair" (p. 143). Finally, for Streeck, mimetic gestures, or enactments, involve the depiction of physical acts or behavior, producing an "abstract, i.e. gestural, version of a real-life act" (p. 145). Enactments "organize experience by enacting, exaggerating, embellishing, and modulating patterns made from the same stuff from which their denotata are made" (p. 147).

The classifications presented here illuminate the different ways in which gestures are formed to represent the world. Importantly, a requirement for representation is that the gesture is recognized *as* a representation by someone (or by a system), however schematized or sketchy it may be. This recognition requires an understanding of the sociocultural practices of gesturing in a given community, as well as of the material and semiotic context in which the gesture occurs, including the verbal utterances and actions performed by the interlocutors (e.g. Enfield, 2011). Meaning emerges through "interaction between the meanings of these gestures and the meanings of their associated words" (Kendon, 2004, p. 163), and, according to Streeck "talk [...] narrowly constrains what recipients expect to see in a depictive gesture" (2009, p. 122). Hence, gestural representation allows us to imagine and understand the particularly relevant dimensions of what is being talked about, but also leads the mind to associate elements and ideas (as discussed in Section 2.3). A broad range of empirical studies has shed additional light on the phenomena discussed so far. In Section 4 we introduce a sampling of these.

4 Empirical Research Strands

There is much to be gained from understanding iconicity in gesture and iconicity in and of itself. However, representational gestures are also studied as a means of investigating a wide range of other questions in language research, including language evolution, language production and comprehension, first and second language acquisition, theories of embodied cognition, neurocognition, language impairments, cross-cultural and cross-linguistic variation, and many others. In this section, we provide a sampling of such studies,

limiting the discussion to language acquisition and development, language and cognition, and computational modeling.

Representational gestures have played an important role in the study of language and cognition over the last century. They have been more widely studied than other types of gestures due partly to the fact that they are highly contextually driven and idiosyncratic, adding "semantic" (i.e. propositional) meaning to an utterance that reflects imagistic mental representation (Hostetter & Alibali, 2008; Kita, 2000; Kita & Özyürek, 2003; McNeill, 1992). This renders representational gestures "the most different from language" (Kita & Emmorey, 2023) compared to conventionalized pragmatic gestures, for example. Gestures produced alongside speech can "activate, package, and explore spatio-motoric representation" (Kita & Emmorey, 2023). That is, they can help us think and "fuel thought and speech" (McNeill, 2005, p. 3; see also Goldin-Meadow, 2003). When McNeill (1992) suggested that gestures provide a "window onto the mind," he was suggesting that (primarily representational) gestures reveal thought, providing insight into cognitive functions and mental representations.

Representational gestures have been shown to help constitute thought (Kita, Alibali, & Chu, 2017). They are language-specific, that is, there is a close tie between the content of a representational gesture and the specific linguistic structure of the co-occurring speech utterance such that speakers gesture differently when the morphosyntax of the accompanying speech utterance is distinctive (e.g. Kita, 2000; Özyürek, Kita, Allen, Furman, & Brown, 2005). Thus, one focus of cross-linguistic variation studies has been how different languages encode different aspects of motion events in speech and gesture, for example, path and manner of movement, and how these strategies reveal patterns that correlate with typological differences (e.g. Kita & Özyürek, 2003; for an overview of cross-linguistic work on iconic and representational gestures, see Mittelberg & Evola, 2014). Other cross-linguistic studies focus on how such variation across languages can reveal culturally and linguistically specific differences in spatial thinking and speaking (Kita, Danziger, & Stolz, 2001; Özyürek, 2018a, 2018b).

The focus on language and thought has generated hypotheses and frameworks such as Slobin's "thinking for speaking" hypothesis (Slobin 1991, 1996; Stam, 2006; cf. Cienki & Müller, 2008; McNeill & Duncan, 2000, on thinking for speaking and gesturing), that has repercussions for research in both first and second language acquisition. To gain competency in a second language, for example, learners have to learn a new way of thinking for speaking, to encode experience according to the semantics and morphosyntax of the target language, and representational gestures can be an important tool in assessing learners' competencies in this regard (Stam, 2015).

There is also an interest in representational gesture that focuses on the acquisition of gesture during the earliest phases of language development (e.g. Andrén, 2010; Capirci & Volterra, 2008; Morgenstern, this volume). Findings from the longitudinal study by Capirci and colleagues (Capirci, Contaldo,

Caselli, & Volterra, 2005) suggest that there is a continuity between the production of the first action schemes, the first gestures, and the first words produced by children, for example, gesture-word combinations precede two-word speech. Similarly related to the root of representational gestures in actions (e.g. Müller, 2014), data from a study of Thai and Swedish children (Zlatev, 2014) suggests that children's first iconic gestures are instantiations of mimetic schemas, that is, bodily gestalts which arise locally through action imitation processes (as opposed to the more universal and abstract image schemas; Cienki, 2013; Mittelberg, 2018). Iconic gestures are also explored in studies that attempt to ascertain the developmental timeline for acquisition of representational gestures in the first two to four years of life. For example, Stefanini, Bello, Caselli, Iverson, and Volterra (2009) found the majority of iconic gestures between 27 and 90 months to be action-based. Questions that arise in this line of research include whether iconic gestures in very early stages of language acquisition are better understood as a conventionalized gesture form learned from adults, or whether they are indeed produced as iconic gestural representations by young children used after they start to speak with increasingly complex morphosyntactic constructions (Nicoladis, 2002, p. 244; see also Mayberry & Nicoladis, 2000). Finally, representational gestures have been shown to make word learning easier than arbitrary gesture forms do (Namy, Campbell, & Tomasello, 2004).

As to the role of gestures in aiding the acquisition of a second language, the findings are not yet conclusive (Gullberg, 2014, this volume). There is evidence that learners often use representational gestures to "elicit lexical help from interlocutors" (Gullberg, 2014, p. 1871), that representational and beat gestures are featured more frequently by instructors and caregivers in second language environments (e.g. Allen, 2000; Lazaraton, 2004), and that they facilitate comprehension for the second language user (e.g. Kelly, McDevitt, & Esch, 2009; Macedonia, Müller, & Friederici, 2011; Nicoladis, 2007; Sueyoshi & Hardison, 2005), in a similar way as they have been shown to do for first language speakers (e.g. Holler, Shovelton, & Beattie, 2009; Rohlfing, 2019). Other studies have also shown that more advanced second language speakers of Spanish produce more representational gestures than beginner second language speakers, but both groups used fewer gestures overall than in their native language (Gregersen, Olivares-Cuhat, & Storm, 2009). Finally, in a study of Japanese learners of French, as proficiency increased, learners moved sequentially from producing predominantly representational gestures related to speech content toward discourse-level gestures (e.g. pragmatic gestures and beats) (Kida, 2005).

The nature of iconicity has recently begun to be explored through computational modeling and robotics (see Jokinen, this volume, for an overview of research on communicative gesturing in robot–human interaction). For example, Bremner and Leonards (2016) explored the comprehension of iconic gestures made by a teleoperated robot and found that participants understood iconic gestures produced by the robot almost as well as when

produced by a human. Robots are also being used to investigate whether social robots can facilitate second language learning in children (de Wit, 2022) with further technological projects resulting, for example, how to improve the design of the robot-performed iconic hand gestures (de Wit et al., 2022), an important endeavor given some evidence that synesthetic gestures do not produce the faciliatory effects attributed to gestures by humans (Kopp, 2017). Computational modeling has also been put to use in the study of iconic gesture, for example, Bergmann and Kopp (2010) looked at systematic and idiosyncratic aspects of iconic gesture production and how these are interrelated by producing a computational model of iconic gesture formation.

The research on iconicity in gesture is, in part, part of a broader resurgence in the interest in motivations behind language structure and its origins (Dingemanse, Blasi, Lupayan, Christiansen, & Monaghan, 2015; Holler & Levinson, 2014; see Liebal & Oña, 2018, and Perlman, Clark, & Tanner, 2014, on ape gesture). The significance of iconicity in spoken and signed languages has been called "a powerful vehicle for bridging between language and human sensori-motor experience [...] [I]conicity provides a key to understanding language evolution, development and processing" (Perniss & Vigliocco, 2014, p. 1). As such, it deserves attention from the wide range of angles, some of which we have introduced here, that continue to inform our understanding of the ways sentient and non-sentient beings represent their inner and outer worlds through gesture.

5 Conclusion

This chapter has highlighted the cognitive-semiotic principles that are at work in the dynamic creation and understanding of iconic (and metaphoric) gestures, which exhibit varying degrees of experiential motivation, routinization, and schematicity. By returning to the Peircean sign model to scope out the semiotic complexity of co-speech gestures, we have attempted to evidence the role of the different subtypes of iconicity as important dimensions of iconic gestural signs that nonetheless also interact with other sign–Object relations such as indexicality and conventionality. We also examined how abstraction, metonymy, and viewpoint jointly underpin the schematic forms of gestures and their potential meanings and functions.

As we hope to have shown, theoretical and empirical research into gesture, as discussed in this chapter, allows for deep insights into the very nature not only of iconicity, but also of meaning and representation more broadly. There remain, however, many issues concerning gestural representation, reference, and enaction that need to be teased apart more fully. The introduction to empirical research in fields both within and adjacent to gesture studies is indicative of the need to pursue the study of iconicity in order to further understand the polysemiotic and multimodal nature of language, whether primarily spoken or signed. Looking ahead, the ongoing study of iconicity

and representation in gesture for their own sakes, and as they relate to fields as diverse as language acquisition, language evolution, and social robotics, will advance our understanding of the kinesic sign processes in which human language, cognition, and interaction are rooted.

References

Allen, L. Q. (2000). Nonverbal accommodations in foreign language teacher talk. *Applied Language Learning*, *11*(1), 155–176.

Andrén, M. (2010). *Children's gestures from 18 to 30 months* (Unpublished doctoral dissertation). Lund University, Lund, Sweden.

Arnheim, R. (1969). *Visual thinking*. Berkeley, CA: University of California.

Bavelas, J., Chovil, N., Lawrie, D. A., & Wade, A. (1992). Interactive gestures. *Discourse Processes*, *15*(4), 469–489. https://doi.org/10.1080/01638539209544823

Bergmann, K., & Kopp, S. (2010). Modeling the production of coverbal iconic gestures by learning Bayesian decision networks. *Applied Artificial Intelligence*, *24*(6), 530–551. https://doi.org/10.1080/08839514.2010.492162

Bouvet D. (1997). *Le corps et la métaphore dans les langues gestuelles: A la recherche des modes de production des signes* [The body and metaphor in gestural languages: In search of the modes of production of signs]. Paris, France: L'Harmattan.

Bremner, P., & Leonards, U. (2016). Iconic gestures for robot avatars, recognition and integration with speech. *Frontiers in Psychology*, *7*, Article 183. https://doi.org/10.3389/fpsyg.2016.00183

Bressem, J. (2013). Empirical research of body, language, and communication. In C. Müller, A. Cienki, E. Fricke, S. H. Ladewig, D. McNeill, & S. Teßendorf (Eds.), *Body - language - communication. An international handbook on multimodality in human interaction* (Vol. 1, pp. 393–416). Berlin, Germany: De Gruyter Mouton.

Bressem, J., & Müller, C. (2014a). A repertoire of German recurrent gestures with pragmatic functions. In C. Müller, A. Cienki, E. Fricke, S. H. Ladewig, D. McNeill, & J. Bressem (Eds.), *Body - language - communication: An international handbook on multimodality in human interaction* (Vol. 2, pp. 1575–1591). Berlin, Germany: De Gruyter Mouton.

Bressem, J., & Müller, C. (2014b). The family of away gestures. Negation, refusal and negative assessment. In C. Müller, A. Cienki, E. Fricke, S. H. Ladewig, D. McNeill, & J. Bressem (Eds.), *Body - language - communication: An international handbook on multimodality in human interaction* (Vol. 2, pp. 1592–1604). Berlin, Germany: De Gruyter Mouton.

Bressem, J., Stein, N., & Wegener, C. (2017). Multimodal language use in Savosavo: Refusing, excluding and negating with speech and gesture. *Pragmatics*, *27*(2), 173–206. https://doi.org/10.1075/prag.27.2.01bre

Bühler, K. (1982). *Sprachtheorie: Die Darstellungsfunktion der Sprache* [Theory of Language: The representational function of language]. Stuttgart, Germany: Fischer. (Original work published 1934)

Calbris, G. (1990). *The semiotics of French gestures*. Bloomington, IN: Indiana University Press.

Calbris, G. (2011). *Elements of meaning in gesture*. Amsterdam, the Netherlands: John Benjamins.

Capirci, O., Contaldo, A., Caselli, M. C., & Volterra, V. (2005). From action to language through gesture: A longitudinal perspective. *Gesture*, *5*, 155–177. https://doi.org/10.1075/gest.5.1.12cap

Capirci, O., & Volterra, V. (2008). Gesture and speech: The emergence and development of a strong and changing partnership. *Gesture*, *8*(1), 22–44. https://doi.org/10.1075/gest.8.1.04cap

Cienki, A. (1998). Metaphoric gestures and some of their relations to verbal metaphoric expression. In J.-P. Koenig (Ed.), *Discourse and cognition: Bridging the gap* (pp. 189–204). Stanford, CA: CSLI Publications.

Cienki, A. (2013). Image schemas and mimetic schemas in cognitive linguistics and gesture studies. *Review of Cognitive Linguistics*, *11*(2), 417–432. https://doi.org/10.1075/rcl.11.2.13cie

Cienki, A., & Müller, C. (Eds.). (2008). *Metaphor and gesture*. Amsterdam, the Netherlands: John Benjamins.

Clark, H. H. (2016). Depicting as a method of communication. *Psychological Review*, *123*(3), 324–347.

Cooperrider, K., & Goldin-Meadow, S. (2017). Gesture, language, and cognition. In B. Dancygier (Ed.), *The Cambridge handbook of cognitive linguistics* (pp. 118–134). Cambridge, UK: Cambridge University Press. https://doi.org/10.1075/gest.12.2.01coo

Cooperrider, K., & Núñez, R. (2012). Nose-pointing: Notes on a facial gesture of Papua New Guinea. *Gesture*, *12*(2), 103–129. https://doi.org/10.1075/gest.12.2.01coo

Danaher, D. S. (1998). Peirce's semiotic and cognitive metaphor theory. *Semiotica*, *119*(1/2), 171–207.

Devylder, S. (2018). Diagrammatic iconicity explains asymmetries in Paamese possessive constructions. *Cognitive Linguistics*, *29*(2), 313–348. https://doi.org/10.1515/cog-2017-0058

de Wit, J. (2022). *I like the way you move: Robots that gesture, and their potential as second language tutors for children* (Unpublished doctoral dissertation). Tilburg University, the Netherlands.

de Wit, J., Willemsen, B., de Haas, M., van den Berghe, R., Leseman, P., Oudgenoeg-Paz, O., Verhagen, J., Vogt, P., & Krahmer, E. (2022). Designing and evaluating iconic gestures for child–robot second language learning. *Interacting with Computers*, *33*(6), 596–626. https://doi.org/10.1093/iwc/iwac013

Dingemanse, M., Blasi, D. E., Lupyan, G., Christiansen, M. H., & Monaghan, P. (2015). Arbitrariness, iconicity, and systematicity in language. *Trends in Cognitive Sciences, 19*(10), 603–615. https://doi.org/10.1016/j.tics.2015.07.013

Di Paolo, E., Cuffari, E., & De Jaeger, H. (2018). *Linguistic bodies*. Cambridge, MA: MIT Press.

Dudis, P. (2004). Body partitioning and real space blends. *Cognitive Linguistics*, *15*, 223–238.

Ekman, P., & Friesen, W. (1969). The repertoire of nonverbal behavior: Categories, origins, usage, and coding. *Semiotica*, *1*(1), 49–98.

Enfield, N. J. (2009). *The anatomy of meaning: Speech, gesture, and composite utterances*. Cambridge, UK: Cambridge University Press.

Enfield, N. J. (2011). Elements of formulation. In J. Streeck, C. Goodwin & C. LeBaron (Eds.), *Embodied interaction: Language and the body in the material world* (pp. 59–66). Cambridge, UK: Cambridge University Press.

Fenlon, J., Cormier, K., Rentelis, R., Schembri, A., Rowley, K., Adam, R., & Woll, B. (2014). *BSL SignBank: A lexical database of British Sign Language* (1st ed.). London, UK: Deafness, Cognition and Language Research Centre, University College London. https://bslsignbank.ucl.ac.uk/dictionary/

Ferrara, L., & Hodge, G. (2018). Language as description, indication, and depiction. *Frontiers in Psychology*, *9*, 716. https://doi.org/10.3389/fpsyg.2018.00716

Fillmore, C. J. (1982). Frame semantics. In The Linguistic Society of Korea (Ed.), *Linguistics in the morning calm* (pp. 111–137). Seoul, Republic of Korea: Hanshin.

Fricke, E. (2007). *Origo, Geste und Raum: Lokaldeixis im Deutschen* [Origo, gesture, and space: Spatial deixis in German]. Berlin, Germany: De Gruyter.

Fricke, E. (2012). *Grammatik multimodal: Wie Wörter und Gesten zusammenwirken* [Multimodal grammar: How words and gestures interact]. Berlin, Germany: De Gruyter.

Gaby, A. (2016). Hyponymy and the structure of Kuuk Thaayorre kinship. In J.-C. Verstraete & D. Hafner (Eds.), *Land and language in Cape York Peninsula and the Gulf Country* (pp. 159–178). Amsterdam, the Netherlands: John Benjamins. https://benjamins.com/catalog/clu.18.08gab

Gibbs Jr, R. W. (2005). *Embodiment and cognitive science*. Cambridge, UK: Cambridge University Press.

Goldin-Meadow, S. (2003). *Hearing gesture: How our hands help us think*. Cambridge, MA: Harvard University Press.

Gregersen, T., Olivares-Chuat, G., & Storm, J. (2009). An examination of L1 and L2 gesture use: What role does proficiency play? *The Modern Language Journal*, *93*(2), 195–208. https://doi.org/10.1111/j.1540-4781.2009.00856.x

Gullberg, M. (2014). Gestures and second language acquisition. In C. Müller, A. Cienki, E. Fricke, S. H. Ladewig, D. McNeill, & J. Bressem (Eds.), *Body - language - communication: An international handbook on multimodality in human interaction* (Vol. 2, pp. 1868–1874). Berlin, Germany: De Gruyter Mouton.

Haiman, J. (Ed.). (1985). *Iconicity in syntax*. Amsterdam, the Netherlands: John Benjamins.

Haiman, J. (2008). In defence of iconicity. *Cognitive Linguistics*, *19*(1), 35–48. https://doi.org/10.1515/COG.2008.002

Hassemer, J., & McCleary, L. (2018). The multidimensionality of pointing. *Gesture*, *17*(3), 416–461. https://doi.org/10.1075/gest.17018.has

Hinnell, J. (2018). The multimodal marking of aspect: The case of five periphrastic auxiliary constructions in North American English. *Cognitive Linguistics*, *29*(4), 773–806. https://doi.org/10.1515/cog-2017-0009

Hinnell, J. (2019). The verbal-kinesic enactment of contrast in North American English. *The American Journal of Semiotics*, *35*(1–2), 55–92. https://doi.org/10.5840/ajs20198754

Hinnell, J. (2020). *Language in the body: Multimodality in grammar and discourse* (Unpublished doctoral dissertation). University of Alberta, Edmonton, Canada.

Hodge, G., & Ferrara, L. (2022). Iconicity as multimodal, polysemiotic, and pluri-functional. *Frontiers in Psychology*, *13*, Article 808896. https://doi.org/10.3389/fpsyg.2022.808896.

Holler, J. & Levinson, S. (2014). The origin of human multi-modal communication. *Philosophical Transaction of the Royal Society B*, *369*(1651), 20130302. https://doi.org/10.1098/rstb.2013.0302

Holler, J., Shovelton, H., & Beattie, G. (2009). Do iconic hand gestures really contribute to the communication of semantic information in a face-to-face context? *Journal of Nonverbal Behavior*, *33*(2), 73–88. https://doi.org/10.1007/s10919-008-0063-9

Hopper, P., & Traugott, E. (2003). *Grammaticalization*. Cambridge, UK: Cambridge University Press.

Hostetter, A. B., & Alibali, M. W. (2008). Visible embodiment: Gesture as simulated action. *Psychonomic Bulletin & Review*, *15*, 495–514. https://doi.org/10.3758/PBR.15.3.495

Jakobson, R. (1966). Quest for the essence of language. In L. R. Waugh & M. Monville-Burston (Eds.), *Roman Jakobson: On language* (pp. 407–421). Cambridge, MA: Belknap Press.

Jakobson, R., & Pomorska, K. (1983). *Dialogues*. Cambridge, MA: Harvard University Press.

Janzen, T., & Shaffer, B. (2002). Gesture as substrate in the process of ASL grammaticalization. In R. P. Meier, K. Cormier, & D. Quintos-Pozos (Eds.), *Modality and structure in signed and spoken language* (pp. 199–223). Cambridge, UK: Cambridge University Press.

Janzen, T. & Shaffer, B. (Eds.). (2022). *Signed language and gesture research in cognitive linguistics*. Berlin, Germany: Mouton de Gruyter.

Johnson, M. (1987). *The body in the mind: The bodily basis of meaning, imagination, and reason*. Chicago, IL: University of Chicago Press.

Johnston, T. (1996). Function and medium in the forms of linguistic expression found in a sign language. In W. H. Edmondson & R. Wilbur (Eds.), *International review of sign linguistics* (Vol. 1, pp. 57–94). Mahwah, NJ: Lawrence Erlbaum Associates.

Kelly, S. D., McDevitt, T., & Esch, M. (2009). Brief training with co-speech gesture lends a hand to word learning in a foreign language. *Language and Cognitive Processes*, *24*(2), 313–334. https://doi.org/10.1080/01690960802365567

Kendon, A. (2004). *Gesture: Visible action as utterance*. Cambridge, UK: Cambridge University Press.

Kendon, A. (2009). Language's matrix. *Gesture*, *9*(3), 352–372.

Kendon, A. (2014). Semiotic diversity in utterance production and the concept of "language." *Philosophical Transactions of the Royal Society B*, 369, 20130293. https://doi.org/10.1098/rstb.2013.0293

Kida, T. (2005). *Appropriation du geste par les étrangers: Le Cas d'étudiants japonais apprenant le français* [The adoption of gestures by foreigners: The case of Japanese students learning French] (Unpublished doctoral dissertation). Université de Provence, Aix-Marseille I, France.

Kita, S. (2000). How representational gestures help speaking. In D. McNeill (Ed.), *Language and gesture* (pp. 162–185). Cambridge, UK: Cambridge University Press.

Kita, S., Alibali, M. W., & Chu, M. (2017). How do gestures influence thinking and speaking? The gesture-for-conceptualization hypothesis. *Psychological Review*, *124*(3), 245–266. https://doi.org/10.1037/rev0000059.

Kita, S., Danziger, E., & Stolz, C. (2001). Cultural specificity of spatial schemas, as manifested in spontaneous gestures. In M. Gattis (Ed.), *Spatial schemas and abstract thought* (pp. 115–146). Cambridge, MA: MIT Press.

Kita, S., & Emmorey, K. (2023). Gesture links language and cognition for spoken and signed languages. *Nature Review Psychology, 2,* 407–420. https://doi.org/10.1038/s44159-023-00186-90

Kita, S., & Özyürek, A. (2003). What does cross-linguistic variation in semantic coordination of speech and gesture reveal? Evidence for an interface representation of spatial thinking and speaking. *Journal of Memory and Language*, *48*, 16–32.

Kopp, S. (2017). Computational gesture research: Studying the functions of gesture in human–agent interaction. In R. B. Church, M. W. Alibali, & S. D. Kelly (Eds.), *Why gesture? How the hands function in speaking, thinking and communicating* (pp. 267–284). Amsterdam, the Netherlands: John Benjamins.

Ladewig, S. H. (2011). Putting the cyclic gesture on a cognitive basis. *CogniTextes*, *6*, 1–23. https://doi.org/10.4000/cognitextes.406

Lakoff, G. & Johnson, M. (1980). *Metaphors we live by*. Chicago, IL: University of Chicago Press.

Lakoff, G., & Johnson, M. (1999). *Philosophy in the flesh: The embodied mind and its challenge to western thought*, New York, NY: Basic Books.

Langacker, R. (1993). Reference-point constructions. *Cognitive Linguistics*, *4*(1), 1–38. https://doi.org/10.1515/cogl.1993.4.1.1

Lazaraton, A. (2004). Gesture and speech in the vocabulary explanations of one ESL teacher: A microanalytic inquiry. *Language Learning*, *54*(1), 79–117. https://doi.org/10.1111/j.1467-9922.2004.00249.x

Liddell, S. K. (2003). *Grammar, gesture and meaning in American Sign Language*. Cambridge, UK: Cambridge University Press.

Liebal, K. & Oña, L. (2018). Different approaches to meaning in primate gestural and vocal communication. *Frontiers of Psychology*, *9*, 478. https://doi.org/10.3389/fpsyg.2018.00478

McNeill, D. (1992). *Hand and mind: What gestures reveal about thought*. Chicago, IL: Chicago University Press.

McNeill, D. (2005). *Gesture and thought*. Chicago, IL: University of Chicago Press.

McNeill, D., Cassell, J., and Levy, E. T. (1993). Abstract deixis. *Semiotica*, *95*(1/2), 5–20. https://doi.org/10.1515/semi.1993.95.1-2.5

McNeill, D., & Duncan, S. D. (2000). Growth points in thinking for speaking. In D. McNeill (Ed.), *Language and gesture* (pp. 141–161). Cambridge, UK: Cambridge University Press.

Macedonia, M., Müller, K., & Friederici, A. D. (2011). The impact of iconic gestures on foreign language word learning and its neural substrate. *Human Brain Mapping*, *32*(6), 982–998. https://doi.org/10.1002/hbm.21084

Mandel, M. (1977). Iconic devices in American Sign Language. In L. Friedman (Ed.), *On the other hand: New perspectives on American Sign Language* (pp. 57–107). New York, NY: Academic Press.

Mayberry, R. I. & Nicoladis, E. (2000). Gesture reflects language development: Evidence from bilingual children. *Current Directions in Psychological Science*, *9*(6), 192–196. https://doi.org/10.1111/1467-8721.00092

Merleau-Ponty, M. (1962). *Phenomenology of perception*. New York, NY: Humanities Press.

Mittelberg, I. (2008). Peircean semiotics meets conceptual metaphor: Iconic modes in gestural representations of grammar. In A. Cienki & C. Müller (Eds.), *Metaphor and gesture* (pp. 115–154). Amsterdam, the Netherlands: John Benjamins.

Mittelberg, I. (2013). The exbodied mind: Cognitive-semiotic principles as motivating forces in gesture. In C. Müller, A. Cienki, E. Fricke, S. H. Ladewig, D. McNeill, & S. Teßendorf (Eds.), *Body - language - communication. An international handbook*

on multimodality in human interaction (Vol. 1, pp. 755–784). Berlin, Germany: De Gruyter Mouton.

Mittelberg, I. (2014). Gestures and iconicity. In C. Müller, A. Cienki, E. Fricke, S. H. Ladewig, D. McNeill, & J. Bressem (Eds.), *Body - language - communication: An international handbook on multimodality in human interaction* (Vol. 2, pp. 1712–1732). Berlin, Germany: De Gruyter Mouton.

Mittelberg, I. (2017). Multimodal existential constructions in German: Manual actions of giving as experiential substrate for grammatical and gestural patterns. *Linguistics Vanguard*, *3*(1), 20160047. https://doi.org/10.1515/lingvan-2016-0047

Mittelberg, I. (2018). Gestures as image schemas and force gestalts: A dynamic systems approach augmented with motion-capture data analysis. *Cognitive Semiotics*, *11*(1), 1–21. https://doi.org/10.1515/cogsem-2018-0002

Mittelberg, I. (2019a). Visuo-kinetic signs are inherently metonymic: How embodied metonymy motivates forms, functions, and schematic patterns in gesture. *Frontiers in Psychology*, 10. https://doi.org/10.3389/fpsyg.2019.00254

Mittelberg, I. (2019b). Peirce's universal categories: On their potential for gesture theory and multimodal analysis. *Semiotica*, *228*, 193–212. https://doi.org/10.1515/sem-2018-0090

Mittelberg, I., & Evola, V. (2014). Iconic and representational gestures. In C. Müller, A. Cienki, E. Fricke, S. H. Ladewig, D. McNeill, & J. Bressem (Eds.), *Body - language - communication: An international handbook on multimodality in human interaction* (Vol. 2, pp. 1732–1746). Berlin, Germany: De Gruyter Mouton.

Mittelberg, I. & Hinnell, J. (2022). Gesture studies and semiotics. In J. Pelkey & P. Cobley (Eds.), *Semiotic movements* (pp. 183–214). London, UK: Bloomsbury Academic.

Mittelberg, I. & Rekittke, L.-M. (2021). Frames und Diagramme im Dialog: Indexikalische und Ikonische Zeichenmodi im Verbal-Gestischen Konstruieren von Reiserouten [Frames and diagrams in dialogue: Indexical and iconic sign modes in verbo-gestural constructions of travel itineraries]. *Zeitschrift für Semiotik* [Journal for Semiotics], *43*(1–2), 81–116.

Mittelberg, I., & Waugh, L. R. (2009). Metonymy first, metaphor second: A cognitive-semiotic approach to multimodal figures of thought in co-speech gesture. In C. J. Forceville & E. Urios-Aparisi (Eds.), *Multimodal metaphor* (pp. 329–358). Berlin, Germany: de Gruyter Mouton.

Mittelberg, I., & Waugh, L.R. (2014). Gestures and metonymy. In C. Müller, A. Cienki, E. Fricke, S. H. Ladewig, D. McNeill, & J. Bressem (Eds.), *Body – language – communication: An international handbook on multimodality in human interaction* (Vol. 2, pp. 1747–1766). Berlin, Germany: De Gruyter Mouton.

Müller, C. (1998a). Iconicity and gesture. In S. Santi, I. Guaïtella, C. Cave, & G. Konopczynski (Eds.), *Oralité et gestualité: Communication multimodale et interaction* (pp. 321–328). Paris, France: L'Harmattan.

Müller, C. (1998b). *Redebegleitende Gesten: Kulturgeschichte – Theorie – Sprachvergleich* [Co-speech gesture: Cultural history, theory, linguistic comparison]. Berlin, Germany: Spitz Verlag.

Müller, C. (2004). Forms and uses of the palm up open hand: A case of a gesture family? In C. Müller & R. Posner (Eds.), *The semantics and pragmatics of everyday gesture* (pp. 233–256). Berlin, Germany: Weidler Verlag.

Müller, C. (2014). Gestural modes of representation as techniques of depiction. In C. Müller, A. Cienki, E. Fricke, S. H. Ladewig, D. McNeill, & J. Bressem (Eds.),

Body – language – communication: An international handbook on multimodality in human interaction (Vol. 2, pp. 1687–1702). Berlin, Germany: De Gruyter Mouton.

Müller, C. (2017). Waking metaphors: Embodied cognition in multimodal discourse. In B. Hampe (Ed.), *Metaphor: Embodied cognition and discourse* (pp. 297–316). Cambridge, UK: Cambridge University Press.

Müller, C., Ladewig S. H., & Bressem, J. (2013). Gestures and speech from a linguistic perspective: A new field and its history. In C. Müller, A. Cienki, E. Fricke, S. H. Ladewig, D. McNeill, & S. Teßendorf (Eds.), *Body – language – communication. An international handbook on multimodality in human interaction* (Vol. 1, pp. 55–81). Berlin, Germany: De Gruyter Mouton.

Namy, L. L., Campbell, A. L., & Tomasello, M. (2004). The changing role of iconicity in non-verbal symbol learning: A U-shaped trajectory in the acquisition of arbitrary gestures. *Journal of Cognition and Development*, *5*(1), 37–57. https://doi.org/10.1207/s15327647jcd0501_3

Nicoladis, E. (2002). Some gestures develop in conjunction with spoken language development and others don't: Evidence from bilingual preschoolers. *Journal of Nonverbal Behavior*, *26*(4), 241–266.

Nicoladis, E. (2007). The effect of bilingualism on the use of manual gestures. *Applied Psycholinguistics*, *28*, 441–454. https://doi.org/10.1017.S0142716407070245

Nicoladis, E., Mayberry, R. I., & Genesee, F. (1999). Gesture and early bilingual development. *Developmental Psychology*, *35*(2), 514–526.

Nielsen, A. K. & Dingemanse, M. (2021). Iconicity in word learning and beyond: A critical review. *Language and Speech*, *64*(1), 52–72. https://doi.org/10.1177/0023830920914339

Özyürek, A. (2018a). Cross-linguistic variation in children's multimodal utterances. In M. Hickmann, E. Veneziano, & H. Jisa (Eds.), *Sources of variation in first language acquisition: Languages, contexts, and learners* (pp. 123–138). Amsterdam, the Netherlands: John Benjamins.

Özyürek, A. (2018b). Role of gesture in language processing: Toward a unified account for production and comprehension. In S.-A. Rueschemeyer & M. G. Gaskell (Eds.), *Oxford handbook of psycholinguistics* (2nd ed., pp. 592–607). Oxford, UK: Oxford University Press.

Özyürek, A., Kita, S., Allen, S., Furman, R., & Brown, A. (2005). How does linguistic framing of events influence co-speech gestures? Insights from crosslinguistic variations and similarities. *Gesture*, *5*(1/2), 219–240. https://doi.org/10.1075/gest.5.1.15ozy

Parrill, F. (2009). Dual viewpoint gestures. *Gesture*, 9(3), 271–289. https://doi.org/10.1075/gest.9.3.01par

Peirce, C. S. (1931–58). *The collected papers of Charles Sanders Peirce*, vols. 1–6, C. Hartshorne & P. Weiss (Eds.), vols. 7–8, A. Burks (Ed.). Cambridge, MA: Harvard University Press. Cited as CP. (Original work published 1866–1913)

Peirce, C. S. (1955). Logic as semiotic: The theory of signs (1893–1920). In J. Bucher (Ed.), *Philosophical writings of Peirce*. New York, NY: Dover.

Perlman, M., Clark, N., & Tanner, J. E. (2014). Iconicity and ape gesture. *Proceedings of the 10th International Conference: The evolution of language* (pp. 228–235). Singapore: World Scientific.

Perniss, P., Özyürek, A., & Morgan, G. (2015). The influence of the visual modality on language structure and conventionalization: Insights from sign language and gesture. *Topics in Cognitive Science*, *7*, 2–11. https://doi.org/10.1111/tops.12127

Perniss, P., Thompson, R., & Vigliocco, G. (2010). Iconicity as a general property of language: Evidence from spoken and signed languages. *Frontiers in Psychology*, 1, Article 115. https://doi.org/10.3389/fpsyg.2010.00227

Perniss, P., & Vigliocco, G. (2014). The bridge of iconicity: From a world of experience to the experience of language. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *369*(1651), Article 20130300. https://doi.org/10.1098/rstb.2013.0300

Rohlfing, K. J. (2019). Learning language from the use of gestures. In J. Horst, & J. von Koss Torkildsen (Eds.), *International handbook of language acquisition* (pp. 213–233). London, UK: Routledge.

Sandler, W., Gullberg, M., & Padden, C. (Eds.). (2019). Visual language. *Frontiers in Psychology*, *10*, 1765. https://doi.org/10.3389/fpsyg.2019.01765

Saussure, F. de (1986). *Course in general linguistics* (W. Baskin, Trans.). New York, NY: McGraw Hill. (Original work published 1916)

Slobin, D. I. (1991). Learning to think for speaking: Native language, cognition, and rhetorical style. *Pragmatics*, *1*(1), 7–25. https://doi.org/10.1075/prag.1.1.01slo

Slobin, D. I. (1996). From "thought and language" to "thinking for speaking." In J. Gumperz & S. Levinson (Eds.), *Rethinking linguistic relativity* (pp. 70–96). Cambridge, UK: Cambridge University Press.

Sonesson, G. (2014). Some issues in the semiotics of gesture: The perspective of comparative semiotics. In C. Müller, A. Cienki, E. Fricke, S. H. Ladewig, D. McNeill, & J. Bressem (Eds.), *Body – language – communication: An international handbook on multimodality in human interaction* (Vol., 2, pp. 1989–1999). Berlin, Germany: De Gruyter Mouton.

Stam, G. A. (2006). *Changes in patterns of thinking with second language acquisition (Unpublished doctoral dissertation).* University of Chicago, Chicago, IL.

Stam, G. (2015). Changes in thinking for speaking: A longitudinal case study. *The Modern Language Journal*, *99*, 83–99. www.jstor.org/stable/43650100

Stec, K. (2012) Meaningful shifts: A review of viewpoint markers in co-speech gesture and sign language. *Gesture*, *12*(3), 327–360. https://doi.org/10.1075/gest.12.3.03ste

Stefanini, S., Bello, A., Caselli, M. C., Iverson, J. M., & Volterra, V. (2009). Co-speech gestures in a naming task: Developmental data. *Language and Cognitive Processes*, *24*(2), 168–189. https://doi.org/10.1080/01690960802187755

Streeck, J. (2009). *Gesturecraft: The manu-facture of meaning.* Amsterdam, the Netherlands: John Benjamins.

Sueyoshi, A. & Hardison, D. M. (2005). The role of gestures and facial cues in second language listening comprehension. *Language Learning*, *55*(4), 661–699. https://doi.org/10.1111/j.0023-8333.2005.00320.x

Sweetser, E. E. (2009). What does it mean to compare language and gesture? Modalities and contrasts. In J. Guo, E. Liven, N. Budwig, S. Ervin-Tripp, K. Nakamura, & S. Özcaliskan (Eds.), *Crosslinguistic approaches to the psychology of language: Research in the tradition of Dan Isaac Slobin* (pp. 357–366). New York, NY: Psychology Press.

Sweetser, E. E. (2023). Gestural meaning is in the body(-space) as much as in the hands. In T. Janzen & B. Shaffer (Eds.), *Signed language and gesture research in cognitive linguistics* (pp. 157–180). Berlin, Germany: Mouton de Gruyter.

Taub, S. F. (2000). Iconicity in American sign language: Concrete and metaphorical applications. *Spatial Cognition and Computation*, *2*, 31–50. https://doi.org/10.1023/A:1011440231221

Taub, S. (2001). *Language from the body: Iconicity and metaphor in American Sign Language*, Cambridge, UK: Cambridge University Press.

Waugh, L. R. (1992). Presidential address: Let's take the con out of iconicity: Constraints on iconicity in the lexicon. *American Journal of Semiotics*, *9*(1), 7–48. https://doi.org/10.5840/ajs19929132

Wehling, E. (2017). Discourse management gestures. *Gesture*, *16*(2), 245–276. https://doi.org/10.1075/gest.16.2.04weh

Wilcox, S. (2004). Cognitive iconicity: Conceptual spaces, meaning, and gesture in signed languages. *Cognitive Linguistics*, *15*(2), 119–148. https://doi.org/10.1515/cogl.2004.005

Wilcox, S. & Occhino, C. (2017). Signed languages. In B. Dancygier (Ed.), *Cambridge handbook of cognitive linguistics* (pp. 99–117). Cambridge, UK: Cambridge University Press.

Wundt, W. (1973). *A psychology of gesture* (J. S. Thayer, C. M. Greenleaf, & M. D. Silberman, Trans.). The Hague, the Netherlands: Mouton.

Zlatev, J. (2014). Image schemas, mimetic schemas, and children's gestures. *Cognitive Semiotics*, *7*(1), 3–29. https://doi.org/10.1515/cogsem-2014-0002