Gestures as Cues to a Target

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1. Introduction

1.1 Targeting gestures = one class of co-speech gestures—this talk's topic

Here, a speaker wants to refer to something—her **target**—located near or far in the physical environment, and to get the hearer's attention on it jointly with her own at a certain point in her discourse.
She inserts at that point a demonstrative like *this, that, here, there* that refers to her target, and she produces a targeting gesture.
Such a targeting gesture must meet two criteria:

a) It is associated specifically with the demonstrative.
b) It helps the hearer single the target out from the rest of the environment.

Targeting gestures provide **gestural cues** to the speaker's intended target.
These are one out of ten categories of cues—representing ten different sources of information—that help a hearer determine a target in a general linguistic process of **targeting** (Talmy, Forthcoming)

Targeting gestures have an extensive range beyond prototype pointing, e.g., those made while saying:

(1) a. That's my horse.
b. This glass is mine and that glass is yours.
c. This group gets in free.
d. This is all declared a wilderness area.
e. This is the pipe we need to fix.
f. This is all just thin air.

1.2 A fictive chain from gesture to target

- Problem: A speaker's targeting gesture is always at a different spatial location than her target. The hearer needs a way to conceptually connect the gesture with the target (unlike, say, a cat that at most just looks at the gesture).
- Proposal: The hearer cognitively generates an imaginal chain of fictive constructs that spatially connect the gesture with the target.
- The fictive constructs consist of structures—schematic, virtually geometric forms; and/or operations that generate or move the structures.

A hearer may tend to conceptually construct such a **fictive chain** in accord with 3 properties:

a. It is fully connected without gaps.
b. It forms progressively from the gesture to the target, not in place all at once, nor from target to gesture.
c. Its progressive unidirectional formation is causal: the gesture gives rise to the first fictive construct, the first construct to the second, etc.

Possible model in a hearer for such a conceptualization: a physical mechanical system.
Its action is progressive, causal, and gapless— no action at a distance.

1.3 Goals and means

Goals: To propose an analytic framework that interrelates targeting gestures in their full range, and a cognitive system that underlies it.
The examples are mostly constructed (as linguists construct expressions for grammaticality judgments).

Videographic analysis of spontaneous gesturing will thus be needed to test out all proposals here. But some support may already exist: many aspects of target gesturing have counterparts in the analysis of fictive motion in linguistics and of perceptual organization in vision science, noted below.

Part 1: Overview of nine categories of targeting gestures

Targeting gestures can be divided into at least nine categories based on the type of fictive construct within a gesture's fictive chain most determinative in singling the target out.

2. Target-intersecting gestures

The gesture generates a fictive construct that intersects with an entity to mark it as the target.

2.1 Possible prototype of this gesture type

E.g, the speaker is in a field with several horses and says:

(2) That's my horse.

Gesture by the speaker: The dominant forefinger, held straight and steady, points at one horse.
Processing by the hearer: The hearer may generate mental imagery in which:

a. The finger's bulk is schematized as a 1-D straight line with a point-like front (at the tip).
b. Emanating from that front point is an intangible **projection**: a 1-D straight fictive line coaxial with the finger's axis.
c. It progresses forward through space rapidly until it **intersects** with a distal object, where it terminates and stops moving.
d. This intersection is a cue that that object is the speaker's intended target.

2.1.1 Counterparts in linguistics and perceptual organization

Linguistic counterpart of the projection: The "demonstrative path" type of fictive motion, as in:

(3) The arrow on the roadsign points to (past / away from) the village.

A 1-D straight fictive line emanates from the arrow's 0-D front point, coaxially with its shaft, and follows the prepositionally specified path.

Linguistic counterpart of the finger's schematization: the "bulk neutral" property of prepositions, as in:

(4) The caterpillar crawled up along the filament / the tree trunk.

The preposition *along* refers to a path moving parallel to and next to a line, and is indifferent to the bulk character of that line.

Perceptual counterpart of the finger's schematization: "skeletal structure", e.g., "axes of elongation" (Marr, 1982), "medial axis transforms" (Feldman and Singh, 2006).

Perceptual counterpart of the projection's coaxiality with the finger's schematized axis: the Gestalt principle of "good continuation" or "colinearity" (Wertheimer, 1923).

Divergences from This Prototype:

2.2 Articulator movement

Instead of holding the forefinger still, the speaker can move it in two main ways:

2.2.1 A thrust.

Gesture: The finger jabs forward along its main axis, e.g., as the speaker says (2).
Processing: The finger **launches** the projection, imparting motion to it at its origin.

2.2.2 A swing.

Gesture: The finger swings laterally (up, down, right, left) about a pivot point (knuckle, wrist, elbow).
Processing: The fictive 1-D projection **sweeps** laterally through space.

2.3 Types of sweep

2.3.1 A sweep onto a nonextended target (one with comparable magnitude in all 3 dimensions)

A projection shoots past the target at the start of a sweep and intersects with it at the end, as in (2).

2.3.2 A sweep along an extended target (one with substantially greater magnitude in one dimension)

Gesture: Speaker swings pointing finger from left to right of the fence while saying:

(5) That fence separates the neighbor's farm from ours.

Processing: The hearer may generate mental imagery in which:

a. the point at which the projection intersects with the fence is itself a fictive construct: a **transect**. (perhaps conceptualized much like the spot of light on the fence from a flashlight)
b. the 0-D transect moves left to right along the fence surface, forming a fictive 1-D line: a **trace**. (perhaps conceptualized much like the spot of light moving as the flashlight swings left to right)
c. the progressing trace follows the structural delineation most salient in the target's geometry, here, the bounded horizontal line of the fence's length.

The trace in effect maps out the target in an operation of **target mapping**.

Linguistic counterpart of such target mapping: the "coextension path" type of fictive motion.

(6) The fence goes from the plateau down into the valley.

The hearer's focal point of attention here imaginally moves along his conception of the fence, much like his fictively constructed transect imaginally moves along his perception of the fence.

2.4 Dimensionality of the projection

So far, a 0-D front point in an articulator has emitted a 1-D linear projection.
But a 1-D front edge (e.g., the fingertips of a flat hand) can emit a 2-D projection, a "planar strip".
E.g., plane of flat hand is vertical, fingers aim forward toward a vertical slot in wall, speaker says:

(7) That's the slot you slide your envelope through.

And a 2-D front plane in an articulator can emit a 3-D volumetric projection.
E.g., the two hands are vertical, thumb beside thumb, palms facing forward; speaker says:

(8) That retaining wall needs reinforcement.

Linguistic counterpart of a planar projector: the "prospect path" type of fictive motion.

(9) The cliff wall faces toward (past, away from) the island.

A 3-D straight fictive shaft emanates from the cliff's 2-D front face, and follows the prepositionally specified path.

3. Target-enclosing gestures

The gesture generates a fictive construct that encloses an entity to mark it as the target.

3.1 Enclosing through projection

2-D enclosing. E.g., speaker wants to target one group of packages under a Christmas tree and says:

(10) Those gifts are for you.

Gesture: A pointing forefinger swings in a loop aimed just outside the area of the gifts.
Processing: The hearer may generate mental imagery in which:

a. A fictive projection from the finger intersects with a point on the floor just outside the gifts.

b. This point— a 0-D transect—moves on the floor, forming a trace: a closed loop surrounding the gifts.
c. If a margin is left between the trace and the gifts' perimeter, an operation of **gap crossing** spans it, in accord with the proposed principle of fictive chains as unbroken.

1-D enclosing. E.g., one flatmate about to move out speaks to another about a section of books along a single shared bookshelf:
(11) Those books are mine.
Gesture: Two flat hands, palms facing each other, fingers pointing forward just above the books aim respectively at either end of the targeted section, then swing down to the level of the books.
Processing: a. Two planar strips project forward to intersect with the back of the bookshelf.
b. Each strip sweeps down along its own plane to between 2 adjacent books.
c. By bookending it, the 2 discontinuous strips enclose the 1D section to single it out as the target.

3.2 Enclosing through radial expansion

-3D enclosing. E.g., one hiker in a woodland says to another:
(12) This is all declared a wilderness region.
Gesture: Both arms are held above the head in a semicircle with fingertips touching, then drawn slowly downward back along the two sides of the semicircle.
Processing: a. The retracting hands leave a linear trace, a fictive semicircle opening downward.
b. In an operation of **shape completion**, fictive planes emerge laterally from the trace, extend around, and form the surface of a hemisphere opening downward.
Perceptual counterpart: closure
c. This dome shape expands radially outward to enclose the targeted volume of space; an operation of **radial expansion**.

4. Target-paralleling gestures

The gesture generates a fictive construct that parallels an entity to mark it as the target.

4.1 1-D paralleling. E.g., ten feet away from a cluster of straight water pipes all oriented in different directions, one plumber says to another:
(13) This is the pipe we need to fix.
Gesture: Straight finger moves forward and back along its axis, oriented parallel to the target pipe.
Processing: One way the hearer may generate mental imagery:
a. The axially oscillating finger emits a self-terminating 1D projection fore and aft.
b. By an operation of **repositioning**, this fictive line moves laterally to coincide with the one pipe parallel with it, marking it as the intended target.
Perceptual counterpart: the Gestalt principle of parallelism.

4.2 2-D paralleling. E.g., facing one wall of a room in their house, one spouse says to the other:
(14) All this old paint has to be removed before putting on the new coat.
Gesture: flat hand held forward, palm facing the wall with fingers pointing up, sweeps left and right in a narrowing descending zigzag.
Processing: One way the hearer may generate mental imagery:
a. The zigzagging flat hand emits a 2-D coplanar projection left and right that terminates at the side walls.
b. This fictive plane undergoes lateral repositioning to coincide with the facing wall.

5. Target-coprogressing gestures

Ontologically, the target here is not an entity or location, but a **path** taken by an entity.
The gesture generates a fictive construct that progresses coaxially and codirectionally with a path

to mark it as the target. It **coprogresses** with that targeted path.

E.g.: in a cowboy movie, a bystander says to the sheriff:
(15) The gunman rode off in that direction / that way / thataway.
Gesture: First the hand is cocked back, the finger is half curled back;
then the hand rotates forward, the finger straightens and jabs forward.
Processing: The finger launches a projection coprogressive with the path, marking it as the target.

6. Target-pervading gestures
The gesture generates a fictive construct that passes through the substance of an entity or the space of a location to mark it as the target.

6.1 The projection sweeps. E.g., the speaker, sitting back from several adjoining tables with cluttered surfaces, when asked where the car keys are, says:
(16) They're somewhere over there.
Gesture: Right arm extended 60 degrees toward left, flat hand facing left;
arm swings in wide arc toward right.
Processing: a. The hand projects a fictive planar strip, its plane vertical.
b. The strip sweeps laterally rightward through the layer atop the tables' surfaces, marking it as the target of the demonstrative *there*.

6.2 The projection penetrates. E.g., Standing outside in Berkeley with a friend, I said about a recent trip:
(17) The weather in Allahabad was about like this.
Gestures: a. I turned a bit away from the friend to direct my body toward the open space of the city.
b. I swelled my chest out a bit.
c. I held my hands as if to "cup" the volume of space from underneath.
d. I turned my head and eyes a bit upward and away, as if to look into the midst of the volume of space.
Processing of a and b:
a. As an articulator with a 2-D planar front, the chest emitted a 3-D volumetric fictive projection.
b. This projection permeated the volume of space to mark it as the target.

7. Target-accessing gestures
The gesture generates a fictive construct, a contoured path, that guides the hearer's attention so that it imaginally accesses an occluded target.

E.g., an apple is at the far edge of a table, a wormhole in its unseen side. The speaker says:
(18) That apple has a wormhole right THERE.
Gesture: The speaker's pointing finger moves forward along a line heading just above the apple,
then the fingertip first bends down, and then bends back toward the speaker in a "J" path.
Processing: a. The finger emits a projection whose front point follows a path geometrically similar to that of the fingertip, but larger through an operation of **scale shifting**.
b. The projection's advancing front point represents the hearer's viewpoint.

Linguistic counterpart: the "access path" type of fictive motion. E.g., a speaker says:
(19) The vacuum cleaner is down around behind the clotheshamper.
The prepositions specify a path that, e.g., the hearer's focal attention or hand could follow to access the referent object.

8. Target-neighboring gestures
Within its maximum reach, the articulator neighbors—but does not touch—an entity to mark it as the target.

Perceptual counterpart: the Gestalt principle of grouping by proximity

E.g., at the end of a singing contest for 10-year-olds lined up in a row on a stage, the MC says:
(20) And this young man is our winner!
Gesture: Standing in front of the line, left of the boy, the MC lowers her extended right arm, palm forward, until the back of the hand is at chest level a foot in front of the boy.
Processing: The operation of gap crossing connects the hand with the nearest object, one particular boy, singling him out from the other children as the target.

8.1 **Engagement**: the parameter of a gesture's degree of spatial/physical engagement with a target.
Least engaged: The fictive chain simply extends across whatever amount of spatial separation exists from the articulator to the target—shown by all the gesture categories before now.
More engaged: the articulator neighbors the target.

9. Target-contacting gestures
Without otherwise affecting it, an articulator contacts an object to mark it as the target.

E.g., a speaker standing by 2 wine bottles says:
(21) This is Bordeau. And this is Chianti.
Gesture: The speaker's fingertip touches 1 bottle's top; then touches the other's top.
Processing: Through a fictive operation of **boundary crossing**, the articulator is conceptually connected with the contiguous target—in accord with the proposed principle of fictive chains as forming progressively from the gesture to the target.

Perceptual counterpart: the visual process of "element connectedness" (Palmer and Rock, 1994).

On the engagement parameter: The articulator here is more engaged with the target than for a target-neighboring gesture.

10. Target-affecting gestures
An articulator already in contact with an object maneuvers/alters it to mark it as the target.

10.1 **Maneuvering**: E.g., same wine bottles and utterance as above, but:
Gesture: With each hand gripping a bottle, first 1 hand lifts and lowers its bottle; then the other hand does the same.
Processing: By an operation of **movement transmission**, the articulator's movement is imagined as being transmitted to the object to mark it as the target.

On the engagement parameter: The articulator here is more engaged with the target than for a target-contacting gesture.

10.2 **Altering**: E.g., a clown holding up a narrow balloon around the middle in each hand says:
(22) I'll bend this one to make a puppy.
Gesture: The right hand squeezes in on the balloon it holds.
Processing: Again, movement transmission from the articulator to the object marks it as the target.

On the engagement parameter: The articulator here is the most engaged with the target, more than for a moving target-affecting gesture.

Part 2: The degree-of-precision parameter

11. The precision parameter

Crosscutting all gesture types above is a "precision parameter", ranging from approximation to precision in a gesture's realization.

Typical correlates: from a more casual faster execution with laxer muscles yielding looser movements, to a more deliberate slower execution with tenser muscles yielding tighter movements.

E.g., a remodeler near an interior wall in a house tells an assistant:

(23) Use your pencil to put an "X" THERE.

Gesture type 1: Finger points approximatively toward a section of the wall.

Processing: The approximativeness licenses "projection widening", yielding a larger-scoped intersection, that calls for a large "X" for where to, say, hang a painting.

Gesture type 2: Finger points precisionally at a spot on the wall.

Processing: The precisionality requires "projection narrowness", yielding a smaller-scoped intersection, that calls for a small "X" for where to, say, drive a nail.

Part 3: More on target-intersecting gestures

12. Other articulators —any body part that can be construed as pointing, including the eye:

The eye can be schematized as a linear articulator with the pupil as the front point, which emits a fictive 1-D linear projection = the speaker's "line of sight".

12.1 The projection advances forward E.g., the speaker is in a field with several horses and says:

(24) That's my horse.

Gesture: The speaker looks steadily at one of the horses.

Processing: The eyes emit a 1-D projection that intersects with one horse, singling it out as the target.

Linguistic counterpart: the "sensory path" type of fictive motion:

(25) I looked at (past / away from) the bell tower.

The line of sight from my eyes progresses horizontally forward along the prepositionally specified path.

12.2 The projection sweeps laterally. E.g., at a party as a newcomer enters, speaker says to friend:

(26) That's my boss.

Gesture: Speaker quickly swivels eyes in a sidelong glance toward the newcomer and back.

Processing: Projection from eyes sweeps laterally into intersection with newcomer to mark her as target.

Linguistic counterpart: a fictive sensory path moving laterally, as for the **down** in:

(27) I slowly looked down into the well.

The line of sight from my eyes first progresses horizontally forward, then sweeps laterally downward, then progresses straight down.

13. An articulator's "outstretch"

An extendable articulator can be stretched away from the body by different amounts in the direction of an object to indicate its relative distance away and thus help single it out as the target.

E.g., a speaker pointing out a 5th-floor window says:

(28) This is my local church's steeple. That further away is the Anglican church's steeple. And that in the distance is the cathedral's steeple.

Gesture: The arm, with forefinger pointing forward, stretches successively further out horizontally.

Processing: a. At each degree of the articulator's outstretch, its projection extends further forward.
b. By an operation of **scale shift**, the magnitude of an articulator's path or distance from the body is multiplied in its fictive construct (here, inches for the hand to miles for the projection).
Perceptual counterpart: metric scaling (Palmer, 1999).

14. Serial gestures and projections

The articulator makes a succession of pointing gestures, each aimed at the next item in a linear array, to mark the whole array as a single compound target.

E.g., there are ten candles in a row along a mantelpiece, and the speaker says:
(29) Those candles all come from different countries.
Gesture: Finger first points at leftmost candle and, as forearm swings rightward, points separately at 3-4 more successive candles; these thrusts are linked laterally by short arcs.
Processing: a. Through **selective attention**, the thrusts are foregrounded and the arcs are disregarded. In general, such arcs may be a "disregard" signal—cf. ASL.
b. The 4-5 candles pointed at are taken to represent the full array—a **target sample**.
c. The effect of the serial pointing is imagined to continue past candle 5 to the end in a fictive operation of **target filling**.

Here, all projections shoot forward, but their successive intersections form a fictive line moving rightward.
Linguistic counterpart: the "pattern path" type of fictive motion, e.g.:
(30) As I painted a stripe on the ceiling, a line of paint spots slowly progressed across the floor.
All paint drops fall vertically, but the successive spots form a fictive line moving horizontally.

15. Starting point of a projection: the locus in space where it is interpreted as starting

So far, all projections have simply started at the articulator. But it can also start elsewhere.

E.g., two hills ten and twenty miles away, the second only a bit visible behind the first. Speaker says:
(31) That's the hill we'll cross today. And that's the hill we'll cross tomorrow.
Gesture 1: finger points directly forward toward nearer hill (prototype pointing).
Gesture 2: The arm is extended upward, with the finger pointing at a downward angle.
Processing for 2: a. An image of the hand moves fictively upward—more than the arm does, by scale shift.
b. Through the operation of repositioning, it moves up to a locus from which the downward angled projection first seems to clear the closer hill.

16. A projection's midcourse direction shift

The 1-D projection, usually straight, is now parabolic.

E.g., with the target out of visual range, the speaker says:
(32) My kite landed way over there.
Gesture: Cocked-back forearm swings forward and cocked-back finger jabs forward and upward at a 45 degree angle; eyebrows raise and head and eyes tilt upward.
Processing: Launched by the articulator, the projection first moves upward at an angle and then, like something thrown, curves back down to intersect with the target.

Part 4: A cognitive fictivity system

A more general cognitive system of fictivity that generates nonperceived spatial constructs may have gradually evolved in the lineage leading to humans, perhaps appearing in:

Visual perception: a. Gestalt principles of closure, grouping, continuation

b. skeletal structure formation, c. forward simulation, d. gesture-initiated fictive chains

Language: a. fictive motion b. schematization of bulk down to skeletal structure

Early science: the Greek extramission theory of sight: the eyes send forth something that contacts what is seen

Cultural concepts: a. emanations of power/magic b. evil eye c. Clackamas Chinook's "Sun Boy" who sets on fire whatever he looks at

Folk iconography: a. Superman's eyes projecting X-ray vision. b. sorcerers' fingertips emitting beams.

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