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Gesture as a conceptual mapping tool

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Introduction

Metaphor is an exercise in conceptual mapping: linking elements of one domain with elements of another. For conventional metaphors, these cross-domain mappings are well entrenched and appear as regular patterns in language and thought. The study of conceptual metaphor is largely about describing these patterns. In actual discourse, meanings are negotiated in the context of activity; here conceptual mappings need to be dynamically established. How do conceptual mappings get set up in discourse? What role, if any, does gesture play? These are the questions that guide the research described in this chapter.

This chapter explores the conceptual mapping process as it unfolds in real time in instructional discourse. In instructional interactions, an experienced participant acts overtly to guide the conceptualizations of a novice. Here, gesture appears to play a key role, both in guiding the mapping of conceptual elements to structures in the environment and in adding structure to the ongoing conceptualization. These functions will be described and illustrated in what follows. First, a few words about the approach of the study are in order.

The functions of gesture highlighted in this work emerge from the interrelation of gesture with talk and the material setting of activity. Talk, gesture, other actions, and the material context must all be included in the unit of analysis. Uncovering the functions of these elements of discourse also requires that we seek relationships between the observable and unobservable: analyzing how talk, gesture, and other actions relate to the conceptual operations that are fundamental to meaning-making. The study described here is innovative in two ways: it tests cognitive linguistic theory in the world of actual discourse and it pushes the analysis of situated activity beyond what we can see. The goal of such research is to deepen our understanding of cognition as a process that spans the internal and external, illuminating how these couple with one another in the performance of complex activities.

The research described in this chapter approaches this goal by integrating two distinct methodologies: (1) cognitive ethnography, which uses participant-observation, interviews, artifact analysis, and recordings of situated activity to analyze how cognitive activities are accomplished in real-world settings, and (2) a form of cognitive linguistic analysis which analyzes patterns in linguistic as well as para-linguistic data (including graphics and gestures) to reveal aspects of conceptual structure and meaning-making operations like conceptual metaphor and conceptual blending. The episodes of instructional discourse analyzed in this chapter come from a cognitive ethnography of time-telling instruction (Williams 2004). Cognitive linguistic analysis of these episodes reveals how each utterance, gesture, and action guides the construction of time readings from the clock display. In these micro-analyses, the mapping function of gesture is revealed.

The chapter begins by discussing conceptual mapping and the role it plays in conceptual metaphor and conceptual blending. It then introduces the key idea that the material world is used to anchor conceptual entities during discourse and problem-solving. Next, the chapter presents data from the time-telling study with step-by-step analyses of meaning construction, highlighting the role of gesture in guiding conceptual mappings. Finally, the chapter concludes with some general discussion of gesture as a conceptual mapping tool.

The importance of conceptual mapping

Conceptual mapping is the fundamental mechanism underlying two related processes of meaning construction: conceptual metaphor and conceptual blending. Conceptual metaphors are patterns of cross-domain mappings that appear in thought and language. Conceptual blends are novel meanings that emerge from online integrations of conceptual content. Metaphoric blends integrate content from distinct domains linked by metaphoric mappings.

Conceptual metaphor is, in the simplest sense, understanding one thing in terms of another. When we hear, “Tomorrow is a big day,” we understand that tomorrow’s events will be important. This is an instance of the conceptual metaphor Important Is Big (Lakoff & Johnson 1980; 1999). The metaphor involves two domains: the size of physical objects and the subjective importance of events. The importance of events is the target domain—what we are thinking and talking about. The size of physical objects is the source domain, a resource used to structure our thinking and communicating about the target. We make use of that resource through conceptual mapping and projection of inferential structure. Elements of the source domain are mapped to counterparts in the target domain. Once the domains have been linked, relations among elements in the source domain are used to draw conclusions about relations among counterparts in the target domain. If we hear, “The day after is even bigger,” we know that the next day’s events will be even more important, and so on. By projecting inferential structure from source to target, we use a familiar domain of experience to support reasoning in a domain that may be less clearly defined. This is the power of conceptual metaphor, a power rooted in the mechanism of cross-domain conceptual mapping.

Conceptual mapping is equally fundamental to conceptual blending. Conceptual blending is the process of integrating disparate conceptual content into meaningful wholes (Fauconnier & Turner 2002). According to conceptual blending theory, language prompts the building of mental spaces—packets of conceptual content—as well as cognitive operations that act on these spaces. Chief among these are conceptual mapping and blending. Conceptual mapping links elements in one mental space with elements in another. Conceptual blending compresses these relations to form new, blended spaces—integrated scenes with emergent structure that supports novel inferences. Research by Fauconnier and Turner (1998; 2002) describes the principles that govern these operations to produce different kinds of conceptual integration networks. Conceptual mapping provides the webbing that holds these networks together.

As an illustration, consider the simple case of the Regatta blend (Fauconnier & Turner 2002). An article in a sailing magazine compares the progress of a catamaran sailing from San Francisco to Boston in 1993 to that of a clipper ship sailing the same route more than a century earlier. The article states: "The crew of the *Great America II* is barely maintaining a 4.5-day lead over the ghost of the clipper *Northern Light*." Interpreting this sentence involves creating a conceptual integration network that includes a blended space and two distinct mental space inputs to the blend. One is the journey of the *Great America II* in 1993 while the other is the journey of the *Northern Light* in 1853. There are many differences between these two events—the era, the type of ship, the crew, the exact path traveled, the weather and sailing conditions—but there is similar event structure: rapid sailing from San Francisco to Boston. The shared structure provides a basis for conceptual mapping across the input spaces. Mappings link counterparts: ship to ship, route to route, and so on. These are selectively projected into the blended space. The ships appear together and the route is fused into one. Time is compressed, bringing a ghost of the clipper from the past into the present, but leaving the particulars of its journey behind. The blended space presents an integrated scene of two ships sailing the same route as rapidly as possible. In the blend, these ships can be construed as competing against one another. Framing the scene as a sailing race (a regatta) supports the inference that one ship is maintaining a lead over the other. Notice that this inference derives from emergent structure in the blended space, not from inferential structure projected from source to target. In this respect, conceptual blending differs from conceptual metaphor, yet both share the critical mechanism of conceptual mapping.

The previous example of conceptual blending is fairly mundane since the input spaces are so similar. The creative power of conceptual blending is revealed when the inputs come from different domains with distinct event structures. One such example is the Boxing CEOs blend (Fauconnier & Turner 2002). Here two corporate leaders (chief executive officers or CEOs) of rival corporations are depicted as competitors in a boxing match. Understanding the depiction involves constructing a conceptual integration network that blends business with boxing. A familiar conceptual metaphor, Competition Is Physical Struggle, provides the basis for conceptual mapping: leaders of corporations involved in business competition (metonymically standing for the companies they lead) are linked to boxers engaged in regulated physical combat. Other mappings follow: the marketplace maps to the boxing ring, government regulation maps to the referee officiating over the match, advertising and price-cutting map to punching and blocking, and so on. In the blended space, one CEO can deliver a knockout punch, rendering the other unconscious; in the business input (the focus of the discourse), this equates to driving the competitor out of business. The novel Boxing CEOs blend shows the creative power of conceptual blending, a power that depends on conceptual mapping to link the disparate inputs.

As the last example suggests, conceptual metaphor and conceptual blending are closely related. Just as conceptual metaphors project inferential structure from source to target, some blends "borrow compression," using the tightly integrated structure of one input space to frame diffuse elements from another (Fauconnier & Turner 2002). In metaphoric blends, source and target elements are integrated in the blended space (Grady, Oakley & Coulson 1999). Whether something is best analyzed as a conceptual metaphor or a conceptual blend is not always clear; the choice depends on such factors as the directionality of the mapping (from source to target vs. across mental spaces), the origin of inferential structure (imported from the source vs. emerging in the blend), and the extent to which the domains are kept distinct or blended. Typically, conceptual metaphor analyses focus on entrenched patterns of cross-domain mappings, while conceptual blending analyses focus on the integration networks that produce novel meanings. It may be that conceptual metaphor is both a distinct form of conceptual integration and, once a metaphor has become entrenched and conventional, a source for cross-domain mappings as in the blending examples described above (more discussion of the relationship between metaphor and blending can be found in Grady, Oakley, and Coulson, 1999, and Fauconnier and Turner, in press). What conceptual metaphor and conceptual blending clearly share is conceptual mapping as a fundamental mechanism.

In this chapter, our focus is the processes of conceptual mapping that form the core of metaphor and blending and how these are realized in discourse. Because the analysis focuses on online meaning construction, the terminology of conceptual integration will be used to describe the various inputs, cross-space mappings, and blends, including metaphoric blends. Emphasis will be placed on the role that gesture plays in linking counterparts in different spaces. To explicate that role, we need to consider how gestures couple with objects in the course of activity.

Conceptual mapping in a material world

Conceptual blends support the generation of inferences. Some inferences depend upon complex sets of relations or the precise way that elements are arranged.

Such things are difficult to keep track of. One way to support such reasoning is to use the material world to anchor blended spaces (Hutchins 2005).

Consider the cultural practice of queuing or standing in line. Here the problem is determining the order of service, and the guiding principle is that people should receive service in the order in which they arrive ("first come, first served"). Standing in line is a way of encoding order of arrival. The arrangement of bodies anchors a conceptual blend that is used to compute whose turn it is to receive service. The anchored blend is shown in Figure 1.

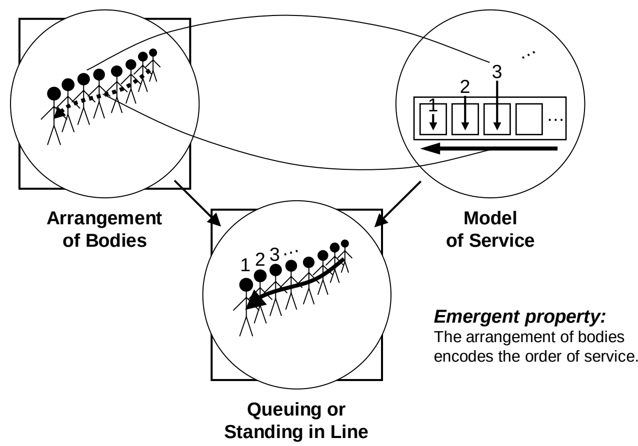

Figure 1. The Queuing or Standing in Line blend. The arrangement of bodies anchors the conceptual blend, stabilizing the representation of conceptual relations. (Adapted from Hutchins 2005.)

One input to the blend is the perceptual scene as shown in the upper left of the figure. Here the circle represents a mental space (perception of people standing in a particular arrangement) while the box behind the circle marks the space as anchored by structure in the environment (the actual physical bodies in the world). The other input, shown in the upper right of the figure, is a familiar conceptual model of service.[1] The model has slots filled according to order of arrival; these slots progress toward the experience of receiving service. Two related conceptual metaphors, Purposes Are Destinations and Progress is Forward Motion (Lakoff & Johnson, 1999) motivate the conceptual mapping. The path of motion of the bodies toward their destination maps to the path of progress toward service, linking each body to a slot in the service model. The blended space, shown at the bottom of Figure 1, has a key emergent property: the arrangement of bodies encodes the order of service. This materially anchored conceptual blend enables the use of spatial configuration to reason about temporal relations. We can infer, for example, that any specific person will receive service after everyone in front of that person and before everyone behind that person; that person #2 will be served just after person #1 and just before person #3; and so on. The environment maintains the configuration of elements so we can reason about who is to receive service when without losing track of the relations. Because the blend is anchored, we can act on the world to generate inferences. We might, for example, shift our gaze from person to person while muttering counting labels *(one, two, three…)* to determine our particular slot in the order of service. This anchored conceptual blend is a cognitive artifact: a tool for computing information with important consequences in activity.

Examples such as this demonstrate how conceptual models and material anchors work in concert to support reasoning (Williams 2004). Conceptual models link elements relationally while material anchors fix the form of those relations in particular instances. Conceptual models are tools for reasoning about the world. They relate effect to cause, part to whole, and so on, but these relations are idealized and topological. The exact configuration of the relations depends upon the particular circumstance; this gives conceptual models the power to apply in many different circumstances. The material world, on the other hand, provides physical structure we can see and interact with—structure that has configuration but no intrinsic meaning. When this structure anchors a blended space, it becomes imbued with significance. Material anchors sustain meaningful relations as we reason, even through multi-step operations. Useful anchors become specialized artifacts, making it possible to dissolve blended spaces and reconstruct them later. Over time, these artifacts and the blends they anchor become highly conventionalized. A clock face, for example, supports conventional sets of blends used to generate different kinds of time readings, some of which will be illustrated in this chapter. Through the symbiotic relationship of conceptual models and material anchors, we reason about the world while we use the world to support reasoning.

Uncovering the conceptual mapping process

How do we marry conceptual models to material structures in particular circumstances? From the perspective of the theory we are developing here, this is a conceptual mapping problem: a problem of linking counterparts. For an expert performer, the process seems to proceed automatically and invisibly. For a novice, it might not proceed at all, necessitating some form of instruction: social interaction through which an expert guides the novice through the process of setting up the conceptual mappings needed to perform successfully.

Consider again the everyday problem of reading the current time. An expert time-teller can look at the configuration of hands on an analog clock and read the time. Some times may be immediately recognized (such as “three o’clock”) while others are likely to be constructed (such as “three forty-two”). A time reading is constructed using anchored blends to generate components such as hours and minutes. Different kinds of time readings (say “five forty-five” versus “a quarter till six") involve different sets of mappings from different conceptual inputs (see Williams, 2004, for a full account). The anchored conceptual blends used to read the time are familiar to the expert and instantiated with little noticeable effort. For a novice with a basic understanding of shape, number, and the division of the day into hours and minutes, there is still much to learn in order to read a clock: which structures on the clock to attend to, which conceptual models to apply, how to map conceptual elements onto the clock face, and how to use the resulting blends to generate time components. Thankfully for the continuation of time-telling as a human practice, these aspects of time reading need not be rediscovered by each new generation of time-tellers. Instead, they can be developed through direct, active instruction from more-experienced time-tellers.

This discussion of novice/expert differences tells us where to look for conceptual mapping *in situ*. Conceptual mapping is likely to reveal itself when one person instructs another in how to interpret some state of the world. Instruction in how to use a cognitive artifact—how to read a clock, for example—is likely to bring conceptual mapping out into the open as a socially mediated process that can be directly observed. These considerations form the basis of the study described here: an investigation of time-telling instruction to uncover the conceptual mapping process and examine the role that gesture plays.

Methods of the study

The data presented in this chapter come from a cognitive ethnography of time-telling instruction (Williams 2004). The study involved participant-observation during mathematics lessons in four classes (1st through 3rd grade) in two elementary schools, a multi-ethnic church school in an urban center and a private school in an affluent coastal community, both in southern California. Data were gathered over the course of a school year by observing mathematics instruction, interacting with students as they worked on assignments, recording lessons related to time-telling, collecting related artifacts, and interviewing students and teachers about time-telling content and methods of instruction. The primary data set for the current investigation consists of recordings of teachers delivering instruction in clock-reading. The ethnographic component of the study is used to provide warrants for specific interpretations of this video data.

Episodes of explicit instruction in clock-reading have been transcribed using a multimodal format based on Goodwin (2003). Speech is depicted in text form with indications of vocal emphasis, pause lengths, etc., in keeping with the conventions of conversation analysis (a full list of conventions is provided in the appendix). Gesture and manipulation of objects are depicted in annotated still images from the video. These images are linked to boxes around speech that co-occurred with the gesture or action. Annotated images were used rather than coded textual descriptions for two primary reasons: (1) the images depict gestures, for which some coding schemes have been developed, as well as manipulations of objects, for which no conventional coding schemes are available; and (2) the analyses depend crucially upon how the gestures couple with the objects, so that a visual depiction provides better support for the analysis than would a written description or code. The annotated images focus on depicting the most significant portion of the gesture, i.e., the gesture stroke; no attempt was made to explicitly notate other gesture phases, although these may appear in the annotations when the hand begins or ends at a position that has other significance.

In the transcribed episodes of explicit instruction, the teacher does nearly all of the talking, gesturing, and manipulation of objects. The analysis follows the transcript line by line, diagramming how each of the teacher's utterances, gestures, and actions affect the mental space inputs, cross-space mappings, and conceptual blends, including which elements are profiled in the discourse. The result of this analysis is a series of diagrams that depict the construction of meaning step by step. The analyses are informed and constrained by the ethnography and by juxtaposing multiple episodes in a search for common patterns. A more detailed description of methods can be found in Williams (2006), including discussion of issues related to using cognitive ethnography to study instruction.

In examining the diagrams of meaning construction, special attention is paid to the functions of gesture and how gesture is coordinated with the accompanying speech and coupled with specific structures in the environment—usually, but not exclusively, structures on the clock face.

The functions of gesture during instruction

In what follows, we examine two excerpts from a single 1st-grade time-telling lesson, chosen for its richness in representing a variety of characteristics found in the study. This lesson took place about midway through the school year. In the first excerpt, the focus is on reading times as "a quarter past…," a relative form of time reading referenced to the previous clock hour. In the second, the focus is on reading similar times as "…fifteen," an absolute form of time reading expressed as an explicit number of hours and minutes. Each of these forms calls for a different set of conceptual mappings to generate the time components. We thus see different conceptual blends being constructed for the same clock display.

Just prior to the first excerpt, the teacher does several things to prepare her students for the clock-reading instruction she is about to deliver. She places a circle made of felt on a display board, covers it with two felt half-circles, and then covers these with four felt quarter-circles; as she does this the students called out "whole," "half," "one fourth," "two fourths," and so on, recalling a recent lesson on dividing a circle into fractional parts. Next, the teacher pulls the upper right quarter-circle away from the others and tells the students that another way to say one fourth is "a quarter." She refers to money (another 1st grade topic), saying that four quarters make a dollar, so one quarter is one fourth. Grasping the upper-right quarter-circle again, she says, “It’s a quarter of the circle,” and places it back with the others. Without fully analyzing these actions, we simply note that they lay the groundwork for what follows: reminding students of the activity of dividing a circle into parts (activating relevant conceptual models and associated vocabulary) and introducing the term “a quarter,” which the teacher explicitly links to the upper right quarter-circle, the one she will focus on in the lesson.

Now the teacher is ready to begin instruction in reading “quarter past” times on the clock. She sits in front of the students and reaches for her teaching clock, an object that looks like a clock face with movable hands. These hands are linked by gears, so that moving the long hand causes the short hand to move in a clock-like way. At this point, the clock-reading portion of the lesson begins. That portion is detailed in Transcript 1, which can be found in the appendix at the end of the chapter. The excerpt is analyzed below.

The Clock Quarters conceptual blend

In the brief episode of instructional discourse (33 seconds) depicted in Transcript 1, the teacher guides students through the construction of the Clock Quarters conceptual blend. Let us first describe this blend using the typical form of a blending analysis. Then we will examine how the blend is actually constructed in the discourse.

In a typical blending analysis, the analyst identifies the inputs and cross-space mappings, describes how relations get compressed in the blended space, examines emergent structure, and discusses how the blend and its associated conceptual integration network are used to generate inferences relevant to the situation at hand. Applying this methodology to the discourse produces the diagram of the Clock Quarters blend shown in Figure 2.

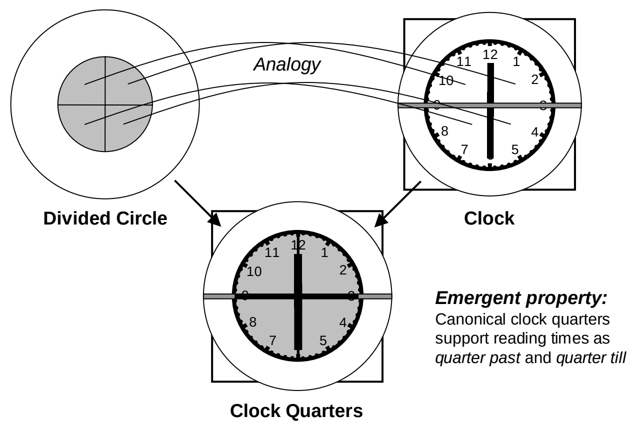

Figure 2. The Clock Quarters blend. The divided circle is mapped onto the clock face, producing the canonical clock quarters.

One input to the blend is the visual perception of the face of the teaching clock, represented by the circle in the upper right of the figure. This circle has a square behind it, indicating that the mental space is anchored by structure in the environment, i.e., by the object the teacher is holding. The other input is the conceptual model of a divided circle, represented by the circle in the upper left of the figure. The idea of dividing a circle into halves and fourths was developed in a previous lesson and reinforced at the start of the current lesson. The divided circle is prototypical: the dividing lines are vertical and horizontal, placing the quarters in a canonical arrangement. This arrangement results from a process of successive halving: dividing the circle first from top to bottom, producing halves, and then from left to right, producing quarters. In the blended space, represented by the circle in the lower part of the figure, the vertical dividing line is anchored by the clock hands while the horizontal dividing line is anchored by a pointing stick placed across the middle of the clock face. Conceptual mappings link the bounded regions on the clock face with the canonical quarters in the divided circle. These Analogy mappings are compressed into Identity in the blended space, producing canonical clock quarters. This emergent structure in the blended space has an important consequence: it supports a new way to name times, as a quarter past the hour. The blend is anchored by material structures, namely the teaching clock and pointing stick, and these material anchors temporarily maintain the part-whole relations of the clock quarters as they are used to generate a “quarter past” time reading.

This typical blending analysis provides important information about the inputs, cross-space mappings, compressions, and emergent structure in the blended space, as well as additional evidence of material anchors for conceptual blends. In other words, it tells us about the *structure* of the conceptual integration network built in the discourse. What it leaves out, however, is the *process* through which the network is built. How are the conceptual mappings set up? What roles do talk, gesture, and other actions in the setting play? To find out, we need to examine the discourse bit by bit, diagramming the developing conceptual integration network at each step of the process.

The process of conceptual mapping

Let us begin our analysis of the process of meaning construction by noting some distinctive features of the discourse. Ordinary conversation is characterized by a fairly even balance of contributions from participants, by false starts and overlaps as turns are negotiated, and by breakdowns and repairs as participants negotiate meaning. In stark contrast to conversation, the discourse transcribed here is one-sided and follows a patterned structure. The teacher talks while the students listen. The teacher controls turns, cuing both the timing and form of student responses. She checks for agreement ("right?" [lines 14, 25]) or prompts for a specific word ("the…" [lines 20-21]). Students reply with simple affirmations ("yeah" [lines 15-16, 26]) or single words ("nine" [line 22]), depending on the form of the cue. The teacher's talk also exhibits a well-ordered structure: a series of single well-formed phrases or clauses, each ending with emphasis on a word or pair of words of conceptual importance, followed by a pause of a half-second or more. The effect is one of introducing one piece of information at a time and waiting for that information to be processed. We see that although the teacher controls the discourse, the form of the discourse is constrained by the memory and processing capacities of the listeners, a group of six- and seven-year-old children. It is the children who must follow every step in the construction of the blend without getting lost or confused along the way.

With this background in mind, let us now examine each step in the construction of the Clock Quarters blend, noting how the mappings are set up. In line 2, the teacher says "if I take my clock" while she picks up the teaching clock. This initiates the conceptual mapping shown in Figure 3.

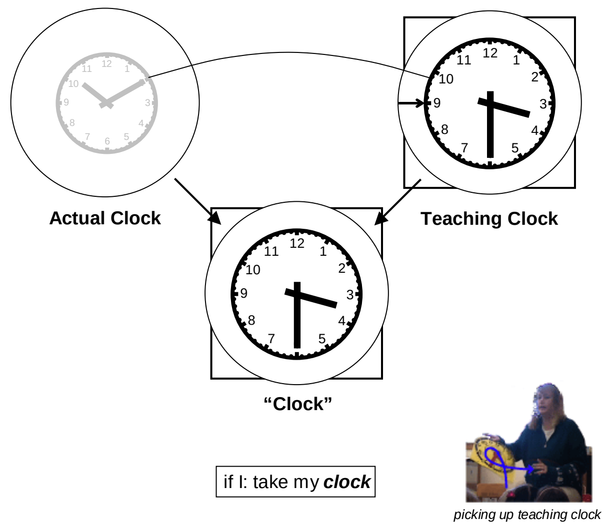

Figure 3. The Clock blend. The teaching artifact is seen as a clock.

The word "clock" activates the domain of clock knowledge, which for the students is still rather limited. They know that clocks are used to tell time, and they have some experience reading the hour and half-hour times. The co-timing of the teacher's utterance and action associates the label "clock" with the object the teacher picks up, which is, of course, not a clock—it does not keep time—but an artifact specially crafted to support instruction in time-telling. Relating utterance to action maps 'clock' onto the teaching clock, a mapping facilitated by the close resemblance between the two. In the anchored Clock blend, the visible portion of the teaching artifact is interpreted as the face of a clock. Students who fail to grasp this will miss the point of the lesson.

Next, the teacher begins constructing the anchored blend that will be used to read "a quarter past." The rest of the transcript depicts this process of mapping the divided circle onto the clock face. The sequence of actions exactly parallels the process of dividing a circle as the students have experienced it in class: first draw a circle, then draw a dividing line down the middle, and then draw a second dividing line across from left to right. In the transcribed excerpt, the teacher uses gestures to "draw" these elements over structures on the clock face.

The first mapping occurs in line 6 when the teacher says "it's the same circle shape" while she traces a circle from the top of the teaching clock slowly around its perimeter clockwise (Figure 4).

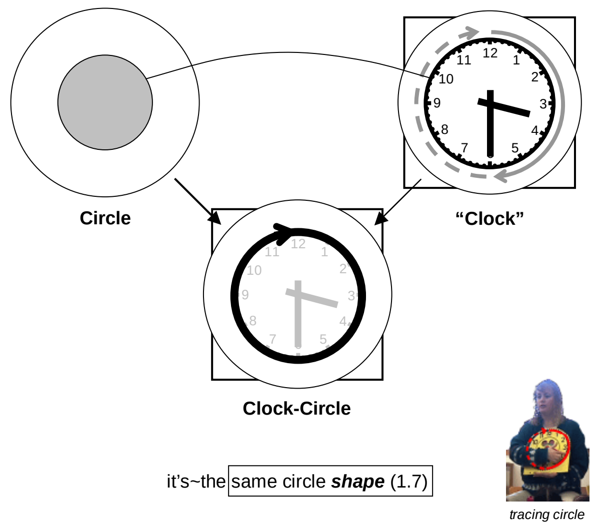

Figure 4. Building the Clock Quarters blend (1). Mapping a circle onto the clock face and enacting a path of clock hand motion.

The trace continues after the utterance has ended and is released when the teacher’s finger reaches the top of the clock again. A trace such as this has both indexical and iconic components (Goodwin 2003). Indexically, a trace highlights structure in the material environment, while iconically, it outlines a conceptual entity. The teacher’s trace highlights the darkly colored band around the perimeter of the teaching clock while simultaneously outlining the shape of a circle. The net effect of the trace is to superimpose a conceptual entity onto a material structure, mapping an element to its anchor. The conceptual mapping results not from the gesture alone but from the relation between the utterance, the gesture, and the material structure. The utterance activates the conceptual model of a circle, profiles the shape of the clock face (i.e., brings it into the foreground as the locus of attention), and sets up an analogical relation between the teaching clock and the circle the teacher displayed on the felt board just before the start of the excerpt. The co-timing of the gesture stroke with this portion of the utterance (“same circle shape”), the form of the gesture (a point carried through a circular path of motion), and the coupling of the gesture with the artifact (tracing over the clock band) provide a set of constraints that guide the mapping of the profiled element (the conceptual circle) to its material anchor (the clock band).

In addition to this mapping function, the gesture in Figure 4 does something more: it depicts a path of motion relevant to time telling. Conceptually, a path of motion has source-path-goal image-schematic structure: a starting point (source), a moving object (trajector), a trajectory of motion (path), and a destination or endpoint (goal).[2] A circle has no beginning or end, but when a circle is drawn, there is a starting point and endpoint to the drawing operation. The starting point and endpoint need not coincide: the drawing can overlap so long as the shape that remains has the appearance of a circle. When tracing a circle on the clock face, the trace can originate anywhere around the perimeter of the clock, it can proceed clockwise or counterclockwise at any speed, and it can end at any point beyond where it started, even making multiple rotations. Indeed, all of these were observed in other data. In the present excerpt, the trace begins at the top of the teaching clock, a considerable distance from the initial hand position (not shown in the transcript), in which the hand grasps the teaching clock at the *8*. The trace proceeds slowly and steadily around the dial clockwise. It continues in steady motion after the utterance has ended and is released exactly when it reaches the top of the dial again. These aspects of the gesture support the interpretation that it reflects more than a simple outline of the clock shape. The gesture appears to enact a path of motion related to the system of time measurement, namely the movement of the long hand through a single clock hour. Nothing about this conceptual content is evident in the teacher's speech or in the artifact she is holding; this source-path-goal structure appears only in her gesture.

The next part of the transcript (lines 8-10) shows another instance of a mapping gesture linking a conceptual element with a material anchor, but here we see the material anchor being prepared just before the mapping gesture is executed. In line 8, the teacher says "and I divide it" as she manipulates the clock hands into a decidedly unclocklike state: short hand straight up and long hand straight down (Figure 5).

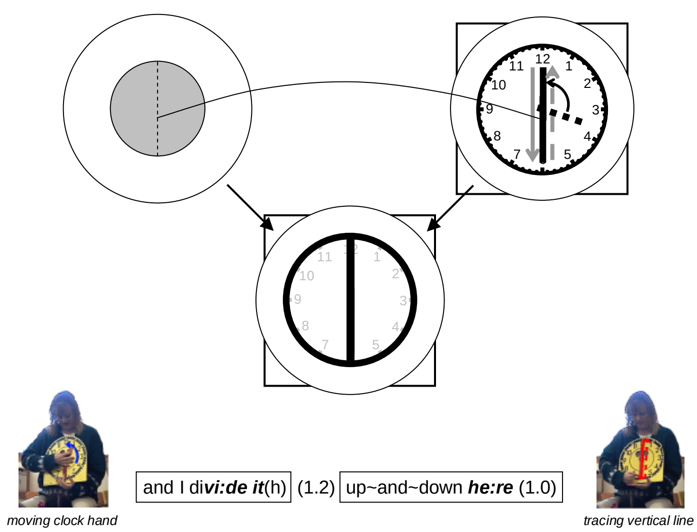

Figure 5. Building the Clock Quarters blend (2). Preparing a material anchor and mapping the vertical dividing line.

Why risk disrupting the Clock blend established in line 2? What the new configuration of the hands does is set up a ready anchor for the next conceptual element to be mapped to the clock face: the vertical dividing line. The teacher superimposes the vertical dividing line over the clock-hand anchor by tracing up and down over the newly aligned hands while saying "up and down here" (line

10, Figure 5). During the last downward stroke, she says "divide it into halves, right?" (line 14). This utterance calls attention to the regions carved out by the dividing line (Figure 6), bringing the halves of the blended clock-circle into profile.

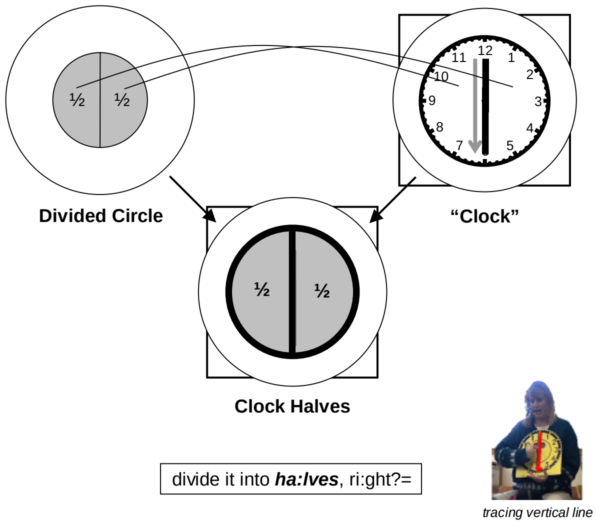

Figure 6. Building the Clock Quarters blend (3). Profiling the regions bounded by the conceptual circle and dividing line.

The teaching clock with its hands arranged vertically anchors the part-whole relation of halves of a circle. In the blend, the moving clock hands have vanished and been replaced by a single stationary divider. In this example, modifying the state of the artifact just before executing the trace prepared the object to couple with the mapping gesture. The trace then highlighted the relevant material structure while outlining the conceptual entity profiled in speech, again superimposing a conceptual element over its material anchor.

The next action (lines 18-26) follows a similar pattern of preparing the material environment to anchor a conceptual element and then using a tracing gesture with speech to link the conceptual and material counterparts. Here there is another variation: the trace is done with the eyes rather than the hands.[3] In this segment, the teacher uses a pointing stick as an anchoring structure. She picks up the stick while saying "now if I wanted to divide it into quarters." On the word "quarters," she places the stick across the face of the teaching clock (Figure 7).

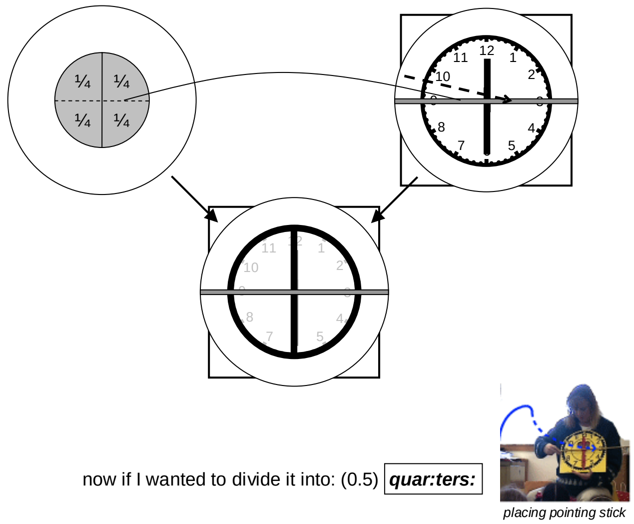

Figure 7. Building the Clock Quarters blend (4). Preparing a material anchor for the horizontal dividing line.

Once the stick is in place, the teacher's hands are occupied, so she executes the mapping gesture with her eyes. While holding the stick, she says "we go from the nine to the three." On the word "nine," she fixes her gaze where the pointing stick crosses the *9*, and then she shifts her gaze along the pointing stick to where it crosses the *3*, saying "to the three" (Figure 8).

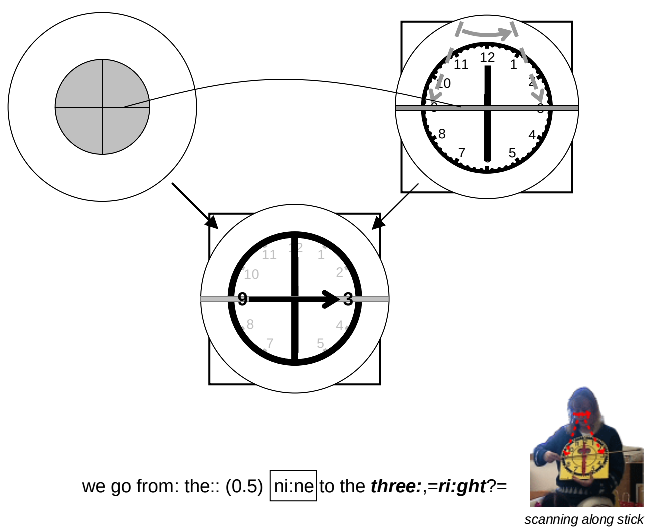

Figure 8. Building the Clock Quarters blend (5). Mapping the horizontal dividing line onto the pointing stick anchor.

The motion description (go from *X* to *Y*) and eye-gesture (a smooth gaze shift as if tracking a moving object) trace a path along the pointing stick that accomplishes two things simultaneously: (1) defining the segment of the pointing stick that is to act as a material anchor, and (2) mapping the conceptual element, a horizontal dividing line, onto that anchor. The speech also calls attention to the *9* and the *3* as landmarks; these will be important for telling time at the quarter-hour marks. As in the previous instance, the teacher then refers to the bounded regions, saying "we have four parts" (line 28). In the blend, this utterance profiles the clock-circle quarters whose configuration is anchored by the combination of objects the teacher is holding (Figure 9).

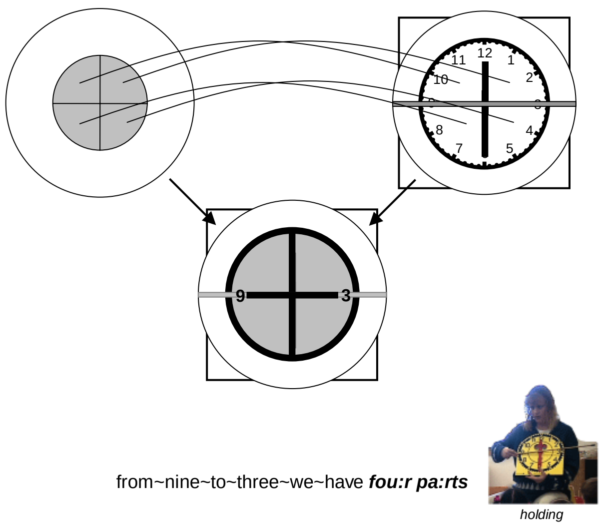

Figure 9. Building the Clock Quarters blend (6). Profiling the regions bounded by the conceptual circle and two dividing lines.

The next utterance, "four equal parts" (line 29) profiles the relationship of the parts: the parts are equivalent in size and shape, a property of canonical quarters (Figure 10).

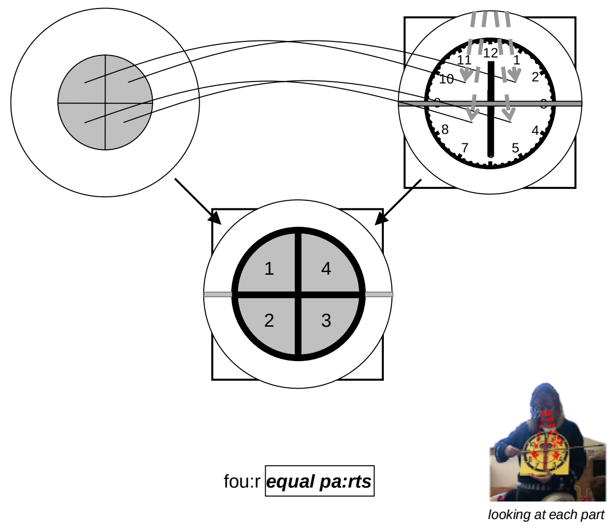

Figure 10. Building the Clock Quarters blend (7). Profiling the equivalence of the parts while pointing to each part with the eyes.

Here again the teacher executes an eye-gesture: as she says “four equal parts,” she glances at each part in turn, performing a sequence of subtle eye-points while her hands remain occupied.

The teacher’s final statement, “on our clock” (line 31), reactivates the clock input from line 2, so that the quarters are seen not in terms of the artifacts the teacher is holding but as quarters of the clock (Figure 11). The Clock Quarters blend is thus a nested blend with both clock and divided circle conceptual inputs. The blend is held together by the configuration of material artifacts—clock face, clock hands, and pointing stick—that anchors the conceptual elements and their relations.

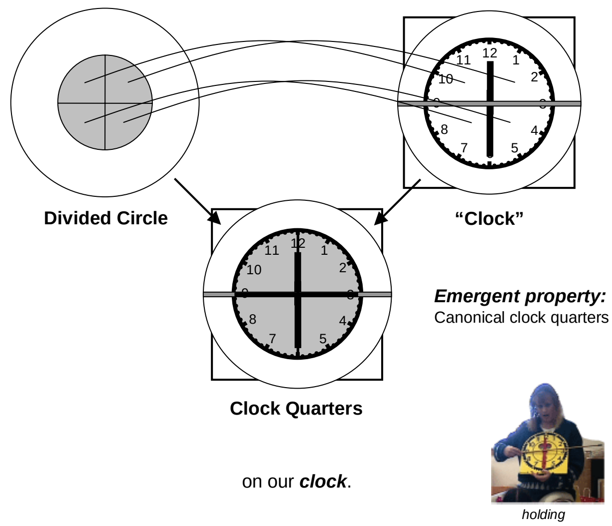

Figure 11. Building the Clock Quarters blend (8). Profiling the clock input. The clock face is metaphorically construed as a divided circle.

The Clock Quarters blend is not only an anchored conceptual blend; it is also a metaphoric blend. Notice the distinctness of the domains and the directionality of the mapping: from the source domain of geometric shapes (and their fractional parts) to the target domain of clocks, specifically the visible structure of the clock face as it relates to time-telling. The focus is on reading the time (the target), not reasoning about circles (the source). Once clock-reading becomes familiar, it can be used as the source domain for other metaphoric blends, as when describing spatial directions relative to the observer as "two o'clock" (ahead and to the right) or "seven o'clock" (behind and slightly to the left). It might seem curious that the metaphor in the Clock Quarters blend maps from the abstract (idealized geometric shapes) to the concrete (the clock face). After all, conceptual metaphor is argued to be the primary mechanism through which bodily experience grounds reasoning in abstract domains such as logic and mathematics (Lakoff & Johnson, 1999; Lakoff & Núñez, 2000). Consider, however, that the divided-circle conceptual model—an idealized cognitive model— was developed through interactions with real objects: cutting paper circles into parts, drawing lines on printed circles, and arranging shapes on a felt board display. Once the conceptual model has been developed, it can be applied (with some help and practice) to other circumstances. Students can find geometric shapes in the visible structure of objects, including seeing quarter-circles in the clock face. The metaphoric mappings project inferential structure (the part-whole relations of quarter circles) onto the clock face, enabling quarter-hour relative time reading.

Now that the teacher has finished constructing the Clock Quarters blend, she is ready to introduce the reading of quarter-past times. She does this in the next segment of the lesson by associating the label "a quarter past" with the upper-right clock quarter, the one bounded by the long hand pointing at the *3*. That portion of the lesson is not included here; further discussion can be found in Williams (2004; in press).

Creating new conceptual mappings for the same clock state

Moments later in the same lesson, after the students have practiced reading several quarter-past times set by the teacher, another episode of explicit instruction occurs. Here the teacher shows the students how to read the same times as "…fifteen," in other words, how to shift from reading quarter-hour relative time to reading absolute time when the long hand points at the *3*. This excerpt of instruction (31 seconds) is detailed in Transcript 2 in the appendix.

The episode in Transcript 2 begins with the students reading "a quarter past three" (line 2), a continuation of practice using the Clock Quarters blend. Line 4 marks the shift to the construction of a new blend, the Clock Counting blend, which the teacher will use to generate the equivalent absolute time reading. The teacher's speech ("now another way that we say it") cues the building of a new mental space for this different conceptualization (Figure 12).

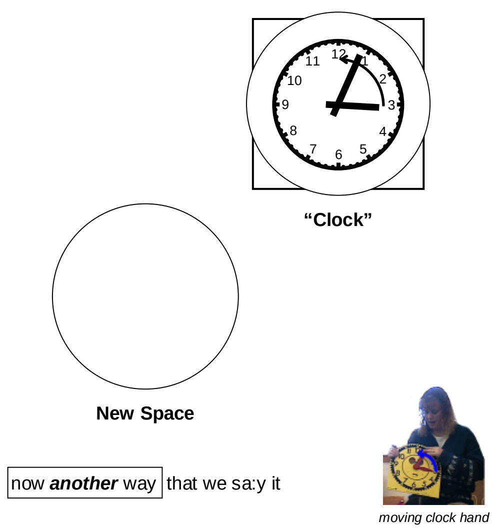

Figure 12. Building the Clock Counting blend (1). Introducing a new space into the discourse while setting the teaching clock to the starting state for the counting process.

As the teacher cues this new space, she moves the long hand counterclockwise to the *12*. Why? The reason becomes clear in what follows. The teacher is setting the artifact to a source state: the initial state of a process that will generate the new time reading. The goal state for that process is the clock display the students have just seen and are about to see differently. The way of getting from source to goal produces the new interpretation of the clock state. Underlying all of this is the conceptual metaphor A Process Is Motion Along a Path From Source To Goal, which is closely related to the Purposes are Destinations and Progress is Forward

Motion metaphors discussed above. In order for students to experience the process and arrive at the appropriate interpretation of the goal state, the teacher must first map each element of a new conceptual input—the conceptual model for counting by fives—onto the relevant structures of the clock face. Here again, gesture is used both as a mapping tool and to add structure to the conceptualization.

Line 6 introduces the counting model. When the teacher says "we count by fives," she refers to an activity familiar to the 1st-grade students, who have practiced counting by fives throughout the school year. Counting is a ritualized activity in which a string of verbal labels is brought into coordination with a series of objects through some repetitive action. The string of labels is learned and recited as a chant (*one, two, three…*). Different strings are associated with different kinds of counting (*one, two, three…* vs. *five, ten, fifteen…* vs. *ten, twenty, thirty…*). The objects to be counted are treated as singular entities when counting by ones and as sets with a consistent number of elements when counting by fives, tens, or some other number. The repetitive action is usually sequential touching, pointing, or gaze-fixing, the latter two being derivative forms of touching (touching at a distance). The verbal label uttered vocally or subvocally when the final object is touched represents the total count. This is the total number of objects (when counting by ones) or the total number of elements in the object-sets (when counting by some other number) in the collection.[4] In order for counting to produce the label that corresponds to the actual number of objects or elements present, the counting action must follow a path with the following properties: it must incorporate every object or object-set in the collection, and it must count each object or object-set only once. The path of the counting action is structured by a source-path-goal schema. The source (or starting point) leads to the first object counted, the path continues through each of the other objects (each only once), and the goal coincides with the last object counted. The next counting label is uttered as each object is intersected. Again we see how a gesture co-timed with speech and coupling with the environment serves a conceptual mapping function. In the case of counting, the gesture maps order in a sequence onto a non-ordered collection of objects. When the purpose of counting is to determine the total quantity of objects rather than to assign order in a sequence, the mapping of sequential order to individual object is quickly forgotten.

In line 6 the teacher says "we count by fives." This utterance activates both the conceptual model for counting and the string of verbal labels to be used (Figure 13).

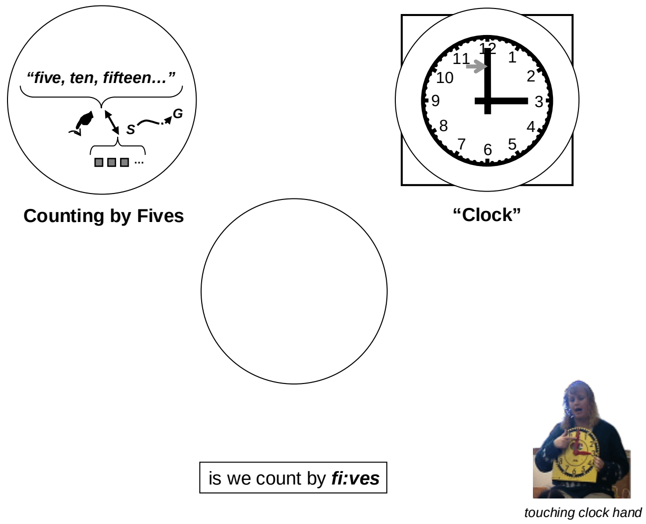

Figure 13. Building the Clock Counting blend (2). Activating the conceptual model for counting and prompting the string of verbal labels to be used.

The next portion of discourse (lines 8-10) sets up a series of conceptual mappings that make counting on the clock possible. In line 8, the teacher says "when we move this" while her pointing finger is held in contact with the long hand on the teaching clock (Figure 14).

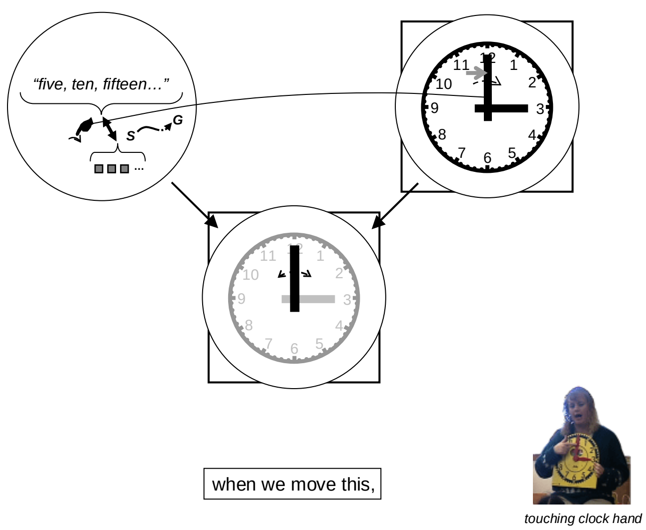

Figure 14. Building the Clock Counting blend (3). Mapping the counting action onto moving the clock hand, metaphorically construing the clock hand as a human hand used to touch objects when counting.

The word “this” prompts a search for a referent, which the touch-point satisfies. Together, the words (“when we move this”) and the gesture (pointing at/touching the long hand) set up the first direct mapping between the counting model and the clock face: they map the counting action to moving the clock hand. This sets up a metaphoric mapping in which the long hand is construed as the finger that touches each object while counting. Notice that the pointing of this metaphorical hand is markedly different from the pointing normally associated with the long hand. In time-telling, the clock hand points to a tick mark or number along the outer dial. In counting, the human hand points to each object as it is counted. In time-telling, the clock hand is driven by an actuating mechanism steadily around the dial, in effect continuously pointing. In counting, the human hand is moved intentionally and sequentially from object to object, with a clear start and finish, pointing only when it comes to rest on each object along the way.

Now that the counting labels and counting action have been established, what remains is to identify the objects to be counted and to specify a path for the count. The objects are identified in the next part of the teacher’s utterance, “from number to number” (line 9), which is accompanied by a sequence of points. As the teacher speaks, she slides her finger to the tip of the long hand and then jumps her finger to the *1*, the *2*, and so on around the dial (Figure 15).

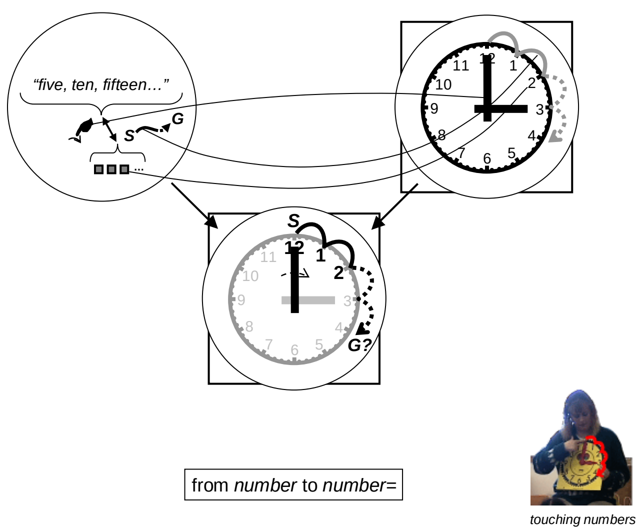

Figure 15. Building the Clock Counting blend (4). Mapping the objects-to-be-counted onto the clock face, creating metaphorical number-objects, and defining a path for the count.

The teacher’s words identify *numbers* as the objects to be counted, and her series of touch-points picks out the numerals on the clock face, guiding the mapping of conceptual elements to specific environmental structures. This mapping elaborates the metaphor in which the clock hand is a counting hand, turning the numerals on the clock face into countable objects.

What about the counting path? The teacher's utterance uses a *from/to* construction with repetition of the word "number," implying a form of iterative motion that corresponds with the typical action of counting, but the actual path of the count is not described in speech. Instead, the path is defined by gesture. The gesture starts at the top of the clock and moves clockwise around the dial, touching several numerals in sequence before falling away. The starting position and path of the count are clearly enacted in the gesture, but the endpoint remains unclear—the gesture is simply dropped in the middle of the next utterance (lines 9-10) after the teacher touches the *4*. Evidence that the gesture defines the counting path comes in the form of the gesture motion. Bouncing from object to object is not the motion of a clock hand; it is, however, the canonical motion of counting, reinforcing the metaphoric construal.

In this counting gesture, as in the clock-circle tracing gesture in the previous excerpt, the gesture embodies image-schematic structure that is not described in speech and not apparent in the environment. The gesture reveals an element of the speaker's conceptualization and makes that element available to be apprehended by others. In both cases, that element is a source-path-goal schema that structures a path of motion. In the clock-circle example, the path structure is incidental: relevant to time-telling but not part of the blend being constructed. In the counting example, it is crucial. The count cannot begin with just any number on the clock face nor can it proceed along just any path that happens to encompass the other numbers. The count must begin at the top of the clock and proceed clockwise, touching each number in sequence, for the correct time component to be generated. The path structure provided solely by gesture must be picked up by the learner—must be part of the learner's conceptualization—for the activity to succeed.[5] This has to happen even while the gesture is performing the mapping function, linking conceptual elements to their material anchors—which in this case also links source domain elements to their target domain counterparts in the metaphoric blend.

As the teacher continues gesturing from number to number, she says "there's five minutes between each number" (lines 9-10), introducing a new conceptual input: the system of time measurement (Figure 16).

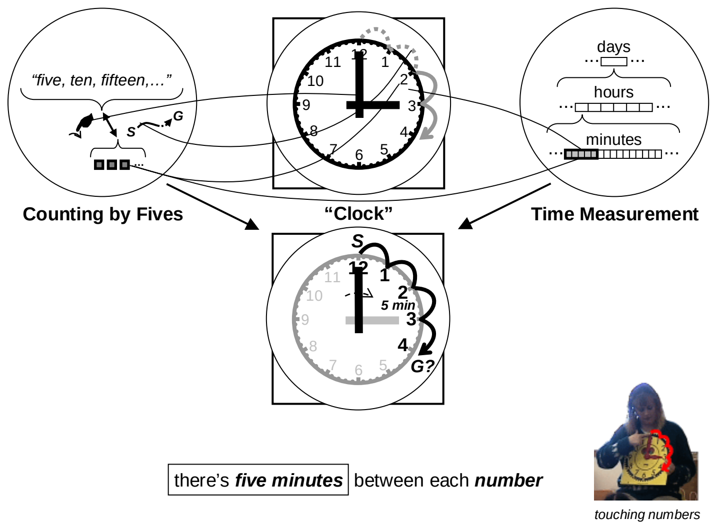

Figure 16. Building the Clock Counting blend (5). Mapping from the system of time measurement to the clock face and implicitly to the counting model. The mappings create metaphorical number-object-sets with five minute-elements.

The teacher's utterance reconstrues her mapping gesture so that it now associates intervals of time with spaces on the clock face, namely the spaces between adjacent numbers (tick marks being entirely ignored in the discourse).[6] This mapping is undergirded by the Time As Space family of metaphors described in chapter 10 of Lakoff and Johnson (1999). Time is commonly conceptualized in terms of motion through space. In the case of the clock, the movement of the long hand from number to number is seen both as occurring in an interval of five minutes and as *defining* an interval of five minutes. In the metaphoric mapping, a "minute" is seen both as a spatial and temporal unit.

The explicit mapping from the system of time measurement to the clock face also sets up an implicit mapping: from the system of time measurement back to the counting model. Recall that the numbers on the clock face have been metaphorically construed as objects-to-be-counted. In the conceptual model for counting by fives, each countable object is a set with five elements. The implicit mapping from time measurement to counting defines these elements as minutes. With mappings from both inputs, the counting model and the system of time measurement, the numbers on the clock face become countable object-sets, each with five minute-elements.

The single gesture that coincides with lines 9-10 of the transcript maps from two distinct conceptual inputs while also adding image-schematic structure to the conceptualization. The first part of the gesture, which co-occurs with "from number to number," maps from the counting model to the clock face while enacting and thus defining the counting path. The continuation of the gesture into "there's five minutes between each number" maps from the system of time measurement to the clock face and implicitly back to the counting model. Although speech and gesture function together to establish mappings, we see here that individual utterances and gestures do not necessarily align in discrete units. In this instance, a single gesture spans two utterances, each cuing a mapping from a different conceptual model. What does seem important for a mapping gesture to succeed is an awareness of the element being mapped. This awareness is facilitated by the co-timing of speech and gesture. Once the mapping is clear, the gesture can be abandoned. Notice that in line 10, the gesture is dropped before the end of the utterance (“between each number”), the referent for “number” having already been established.

Now that all of the mappings for the Clock Counting blend are in place, the teacher is ready to “run the blend,” i.e., to use it to generate a time component. In the discourse, this shift to running the blend is cued by the utterance “so if we were going to count by fives it would be” (line 12), which specifies how the actions the teacher is about to take are to be construed, namely in terms of the conceptual integration network she has set up (Figure 17).

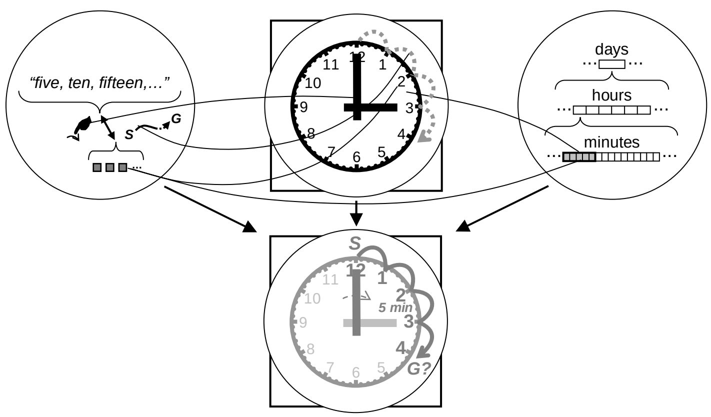

Figure 17. Running the Clock Counting blend (1). Cuing the transition to running the blend to generate a time component.

The teacher runs the blend by grasping the long hand and moving it to the *1*, the *2*, and the *3*, pausing at each number to look at the students and utter the corresponding counting label: “five,” “ten,” “fifteen” (lines 13-21, Figure 18).

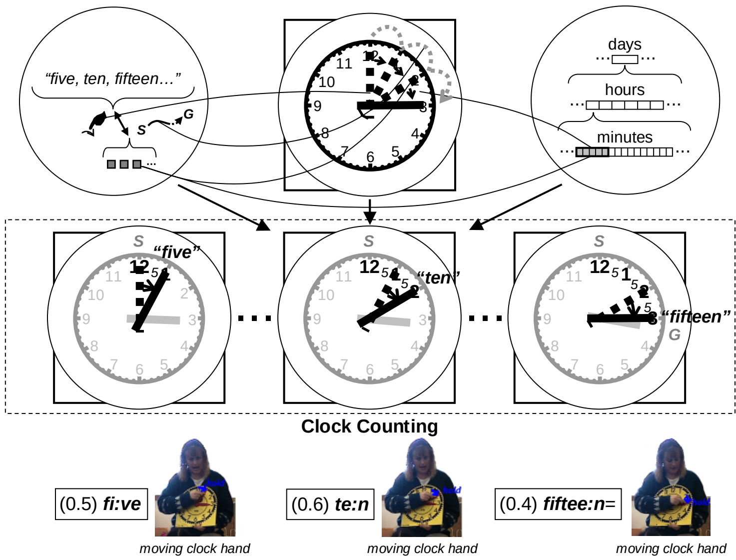

Figure 18. Running the Clock Counting blend (2). Executing the counting process to generate the minute portion of the absolute time reading.

The teacher enacts the counting process she was preparing for when she moved the clock hand to the source state near the start of the excerpt, just before executing the series of conceptual mappings. The goal of the count finally becomes apparent when the teacher releases the long hand after counting the number-object *3* as "fifteen." To a 1st-grader, pointing at the symbol *3* and calling it "fifteen" could seem nonsensical, but it makes perfect sense in the blended space the teacher has constructed. In the Clock Counting metaphoric blend, the long hand is the pointing-finger proxy that touches each number-object as its associated label is uttered. Each of these movements spans an interval of five minutes, so that a total of fifteen minutes have been spanned when the long hand reaches the *3*. This motivates the reading of the resulting clock state as "…fifteen." The logic of this, namely that three times five is fifteen, is likely to elude the students for some time, but the practice of counting by fives on the clock face while pointing at the numerals, when coordinated correctly, will produce the correct minute portion of an absolute time reading, even in the absence of this deeper understanding.

The teacher's final statement (lines 22-27) equates the relative and absolute time readings (Figure 19).

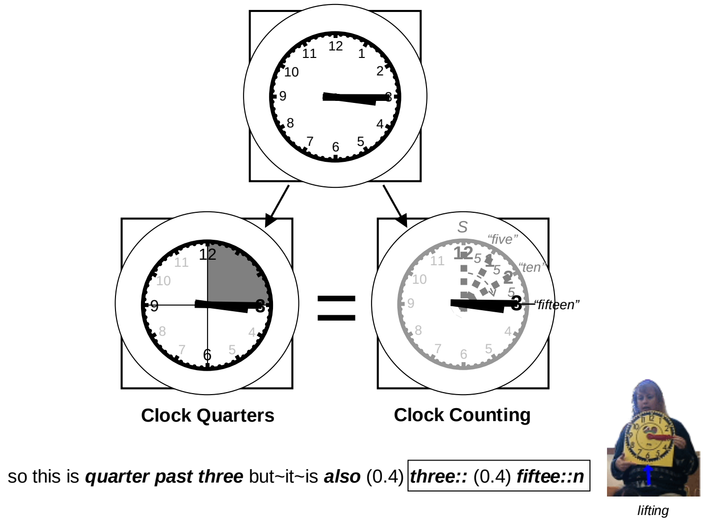

Figure 19. The same anchor for different blends. Establishing the equivalence of the different ways of reading the time.

Here the same configuration of material structure anchors two completely different blends—each involving a unique conceptual integration network used to generate a particular kind of time reading.[7] Compare the image in lines 25-27 with the image at the start of the excerpt in line 2. They are nearly identical. Within a span of thirty seconds, the same clock state appears twice yet is seen differently each time it appears. This is a vivid illustration of the situated nature of seeing. Seeing is bound up with the context and purpose of activity. What is seen depends upon the conceptual models and mappings used to generate inferences relevant to the task at hand. The divided-circle and counting models support different inferences related to different ways of reading the time. In the instructional situation, the students are learning to “see” the clock in ways that support proficient time-telling. Here, Understanding Is Seeing is both metaphorical and literal.

Making meaning in activity

In the examples presented in this chapter, two distinct ways of seeing the clock—two distinct metaphoric blends—arise from different sets of conceptual mappings set up in the course of a single clock-reading lesson. The mappings are cued by the orchestration of talk with action-in-the-setting and constrained by the nature and purpose of activity.[8] In the time-telling lesson, picking up the teaching tool while saying “take my clock” maps “clock” onto the artifact the teacher is holding. Running a finger along the clock band while saying “same circle shape” maps a conceptual circle onto the clock band. Scanning along the pointing stick while saying “go from the nine to the three” maps a conceptual dividing line onto a segment of the stick (and makes the rest of the stick irrelevant). Pointing at the long hand while saying “when we move this” makes the clock hand a human-hand proxy for touching objects when counting. Touching the sequence of numerals on the clock face while saying “from number to number” establishes numbers as the objects-to-be-counted while defining the counting path. Continuing the gesture while saying “there’s five minutes between each number” maps intervals of time onto segments of the clock face, implicitly mapping minutes to elements of the object-sets being counted. In each case, gesture is a tool for mapping conceptual elements to material anchors, for binding conceptual models to the world. When the mappings are metaphoric, gesture unites the source and target domain counterparts.

A scan over the mapping gestures listed above reveals a distinct difference between those that appear in the first excerpt and those that appear in the second. In the first excerpt, the mapping gestures are traces; in the second, they are points. This difference can be resolved if we remind ourselves that a trace consists of a point plus an iconic component (Goodwin 2003). In both excerpts, the pointing component of the gesture picks out the material structure that participates in the mapping. This may be a single structure (the long hand), several structures (the numbers on the clock face), or a portion of structure (a segment of the pointing stick). As the point picks out material structure, speech cues the conceptual element or elements to be mapped. In the tracing gestures, an iconic component added to the point outlines the conceptual element profiled in speech, superimposing it on the anchor. A purely iconic gesture for a circle could simply draw the circle in the air, but an iconic/indexical trace draws the circle on top of an environmental structure. Iconic components are lacking in the gestures in the second excerpt most likely because the counting model lacks the geometric character of the divided-circle model and so is less fundamentally visual-spatial. Iconicity does appear in the enactment of the counting motion. Here the iconic component highlights the information provided solely in gesture, namely the counting path. We ought to expect that mapping gestures which link conceptual entities to the material environment will be indexical; the extent to which they are also iconic seems to depend on the nature of the relevant conceptual model and the unfolding activity.

That gesture is used as a conceptual mapping tool is also evident in the ways that the teacher prepares the environment to receive mapping gestures. Most obviously, she places a pointing stick across the clock face to anchor the horizontal dividing line. Before that, she presses the hands of the teaching clock apart—overriding the gearing that keeps them in clocklike alignment—to create an anchor for the vertical dividing line. Later, she moves the long hand back to the *12* (the starting count position) just before setting up the metaphoric mapping that makes it a proxy for the counting hand. In each of these examples, the teacher brings the world into alignment with the conceptual model before executing the gesture that maps element to anchor.

If mapping gestures are used to construct anchored blends, are they obligatory to the process? Perhaps the mappings could have been set up solely in speech with sufficient prompting and feedback, but the properties of gesture make it an efficient medium for indexing structures in the environment and superimposing outlines of conceptual entities directly over their relevant counterparts. Gesture is also well-suited to depicting paths and manner of motion. In short, speech, gesture, and material objects are different representational media with different properties. Speech is sequential and symbolic; gesture is visual-spatial, motional, and enactive. Speech readily cues other times and epistemic states (hypotheticality, for example), to which gesture may then also refer; gesture couples readily with structure in the environment. Both are transitory: speech loses its representational state as rapidly as it appears, while gesture can be sustained for a brief duration. In contrast to speech and gesture, the material environment is durable, but it takes more work to develop representations there. Mapping gestures are one way of coordinating speech with the setting, rapidly assigning representational states to bits of the world that anchor those states as we reason and communicate.

How are mappings sustained through time? Mappings set up in discourse are likely to be forgotten as soon as the activity is over. Instruction must be followed by practice, and often more instruction, until the blends that support the activity become habitual. When innovative mappings do arise in discourse, they may be picked up and reiterated by other participants. If the ensuing blends prove helpful, they may be re-used and shared. Useful blends create pressures to modify the world in their support, leading to the crafting of artifacts that support particular practices and instruction in the use of those artifacts. This seems to have occurred in the development of time-telling. The earliest anchors for time-telling were such things as shadows moving across landmarks. To these, scales were added, leading to the crafting of sundials and eventually mechanical (and later electronic and atomic) clocks, devices that anchor the system of time measurement. Because clocks change state in a systematic way, they stand as ready anchors for the blends used to generate time readings. This marriage of material artifacts and conceptual models, a union realized through conceptual mapping, enables us to do something we could never do in our heads: tell the time. That is no small achievement. Instructional discourse—including mapping gestures—sustains this sophisticated activity across generations. That is no small achievement either.

Conclusion

In instructional discourse in time-telling, gestures are used to map conceptual elements profiled in speech to specific structures on the clock face (and other objects). When these mappings cross distinct domains, they can produce metaphoric construals of structure in the world, such as a clock hand as pointing finger. Further research is needed to illuminate the relationship between the mapping gestures described here and the metaphoric gestures described by McNeill (1992), in which the gesturing hand itself seems to serve as a material anchor for a conceptual element. In addition to guiding conceptual mappings, the gestures analyzed in this chapter also enacted paths of motion that were variously incidental or crucial structuring elements of the task-specific conceptualization.

Mapping gestures like those described in this chapter seem to be a particularly useful tool for instruction, a form of social interaction in which one participant overtly guides the conceptualization of another. The extent to which mapping gestures occur in other forms of discourse remains to be investigated. It may be that instruction, because it involves such overt guidance, is more likely to bring conceptual mapping out into the open and into the gestures of participants. We should be careful, however, not to underestimate the number of times that instruction surfaces in ordinary discourse in a variety of settings, even if only for a few fleeting moments. It does not take long to construct an anchored blend. Even in a formal school setting with young learners, the teacher in our examples took only about thirty seconds to set up all of the necessary mappings.

Finally, it is worth noting that the mapping function of gestures described in this chapter would not be apparent if we restricted our definition of discourse to the talk that participants produce. Nor could it be understood if we treated speech and gesture as distinct channels of communication. The analysis of mapping, blending, and metaphoric blending presented here rests on the assumption that discourse is inherently multimodal—that it encompasses talk, gesture, and action coupled to the setting of activity. It is only in the coordination and interrelation of these elements that meaning emerges.

Acknowledgments

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Notes

1. This conceptual model could also be called a “cultural model” because it is intersubjectively shared by members of a cultural group, or a “frame” because it is used to frame the situation (to structure the roles and relations). For the purposes of this chapter, I will use the generic term “conceptual model.”

2. Image schemas are recurring patterns in embodied experience that are important structuring elements to conceptualization (Johnson 1987). A brief overview of source-path-goal and other common image schemas can be found in Lakoff and Johnson (1999).

3. Gestures are generally regarded as movements of the hands and arms, but we can point with our bodies in many ways, especially when our hands are occupied or when the social situation demands subtlety (such as that the point be understood by compatriots but not by others). Although less prototypical than a finger-point, an eye-point or eye-trace can function in a similar way. In this respect, I classify them together.

4. Other variations of counting exist which involve different anchored blends. More examples can be found in Williams (2007).

5. See Cienki (2005) for experimental evidence that discourse participants are sensitive to image-schematic structure represented in gesture.

6. The use of a singular object with between ("between each number") merits further discussion. Simply put, *between each* X_i implies between X_1 and X_2, between X_2 and X_3, and so on. Another example would be to say "there's ten minutes between each class" to describe the passing period between each pair of adjacent classes in a university schedule.

7. I here ignore how the hour portion of the time reading is constructed since this was not mentioned in the lesson. Reading the hour also relies upon anchored blends, and these, too, differ for relative and absolute time readings. For a complete discussion, see Williams (2004).

8. See Hutchins and Palen (1997) for similar claims about how meaning is constructed from space, gesture, and speech. Hutchins and Palen talk about the construction of complex, multilayered representations in the communication among members of a cockpit crew. The present chapter is similar in spirit but uses a different analytical framework, that of conceptual mapping and blending.

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Appendix

Transcript conventions:

bold italics	vocal emphasis
italics	slight emphasis
~	rapid speech
..	slow speech
o: r:: s:::	lengthening of sound
(h)	aspiration
-	abrupt cut-off
=	conjoined speech
[	overlapped speech
CAPS	loud speech
°	soft speech
!	excited speech
?	rising intonation
.	falling intonation
,	rising-falling intonation
(0.5)	pause length in seconds
[boxed speech]	co-occurrence with gesture/action in linked image
(?)	uncertain transcription
((*inaudible*))	transcriber's comment

Transcript 1

clockqtrs (0:33)

1 (0.7)
2 Teacher: if I: take my ***clock***

3 (0.6)
4 (S?): ((*whoop*))
5 (0.6)
6 Teacher: it's~the same circle ***shape***

7 (1.7)
8 and I di***vi:de it***(h)

9 (1.2)
10 up~and~down ***he:re***

11 (0.2)
12 S1: °half
13 (0.8)
14 Teacher: divide it into ***ha:lves***, ri:ght?=

15 S1: [yeah
16 S2: [m-hm yeah
17 (0.3)
18 Teacher: now if I wanted to divide it into:
19 (0.5)
20 ***quarter:s:***

21 (3.7)
22 we go from: the::
23 (0.5)
24 S+: n[ine ((*inaudible*))
25 Teacher: [ni:ne to the ***th***[***ree:***,=
26 S4: [three!

27 Teacher: ***ri:ght***?=
28 S5: ***yea:h***.
29 (0.5)
30 Teacher: from~nine~to~three~we~have ***fou:r pa:rts***
31 fou:r ***equal pa:rts***

32 (0.4)
33 on our ***clock***.
34 (1.9)

Transcript 2

3fifteen (0:31)

1		(4.0)
2	Ss:	A QUARTER PAST THREE

3		(0.8)
4	Teacher:	now ***another*** way that we sa:y it

5		(1.0)
6		is we count by ***fi:ves***
7		(0.3)
8		when we move this,

9		from *num*ber to *num*ber=there's ***five minutes***
10		between each ***number***

11		(0.6)
12		so if we were going to count by ***fives*** it would be:
13		(0.5)
14		***fi:*** [***ve***
15	S:	[five

16		(0.6)
17	Ss:	te:: [n
18	Teacher:	[***te:n***

19		(0.4)
20	Ss:	[fiftee:n
21	Teacher:	[***fifteen***=

22		so this is ***quarter past three*** but~it~is ***also***
23		(0.4)
24		***three::***
25		(0.4)
26	Ss:	[fiftee:n.
27	Teacher:	[***fiftee::n***