In T. Oakley & A. Hougaard (eds.), *Mental Spaces in Discourse and Interaction* (pp. 209-234).
Amsterdam: John Benjamins, 2008. Last revised: October 24, 2007.
(There may be minor editorial changes in the published chapter.)

# Guided conceptualization

## Mental spaces in instructional discourse

Robert F. Williams
Lawrence University

### Introduction

Originally devised to address issues of reference in the philosophy of language, the theory of mental spaces (Fauconnier 1994, 1997) has proven to be such a powerful tool for linguistic analysis that it is considered one of the foundational theories of cognitive linguistics. The present chapter, like others in this volume, aims to demonstrate the utility of mental space theory for analyzing the construction of meaning in real discourse and interaction. This research is important for two reasons. First, mental space theory shows promise for illuminating aspects of discourse which have not been adequately explained by studies using other approaches. Chief among these is the relation between observable behaviors—talk, gestures, and physical manipulation of the environment—and the conceptual operations used to construct meaning. This link between the external and internal is crucial to our understanding of how human cognition and communication function in real-world activity. Second, studies of actual discourse provide a way to test and refine mental space theory itself. Since its inception, mental space analysis has been fruitfully applied to "problem" sentences and linguistic constructions of many kinds, including both invented and attested examples of language use. The time has come to push mental space analysis into the messy world of real human interaction, both to see what insights might be gleaned there and to see how far the theory can take us.

With this in mind, the present chapter presses mental space theory into the analysis of instructional discourse. Instruction is a means through which one participant guides the performance and shapes the understanding of another. Prototypically, instruction is directed from an expert (teacher) toward a novice (learner), although interludes of instruction can surface in many kinds of discourse among co-participants with different conceptions or levels of understanding. How does instruction actually function? What can mental space analysis reveal about the process? These questions will be addressed using samples of in-

structional discourse drawn from a study of time-telling instruction (Williams 2004). Before we turn to the data, it will be important to introduce three key ideas, one having to do with the unit of analysis and two others with the conceptual framework used to analyze the data.

## Three key ideas

The first key idea is to define the unit of analysis, i.e., what constitutes the discourse, in a way that does not do violence to the phenomena we wish to understand. In the research presented here, the discourse is taken to include the spoken language of the participants, their gestures, and their physical interaction with objects in the setting. As we will see, this broad unit of analysis is needed to reveal the means through which the teacher shapes the conceptualization of the learners and to illuminate how talk, gesture, and manipulations of objects interact to craft the meanings essential to performing the task (see Hutchins and Palen [1997] for related discussion).

The second key idea relates to the conceptual framework used in the analysis. This framework is an elaboration of mental space theory called "conceptual integration theory" or the theory of "conceptual blending" (Fauconnier & Turner 1998, 2002). Conceptual integration theory describes how mental spaces are linked with one another to form conceptual integration networks. These networks produce blended mental spaces that integrate content from diverse inputs, often in novel ways. The creative power of conceptual blending provides a dynamic mechanism for constructing meaning moment-to-moment in specific contexts; it is exactly that power that will be illustrated in the examples that follow.

To the theory of conceptual blending we add the third key idea: the use of the physical world to "anchor" blended mental spaces (Hutchins 2005). In an anchored blend, the physical world fixes a constellation of conceptual elements so that we can reason about them without losing track of their intervening relations. A simple example discussed by Hutchins (2005) is the cultural practice of queuing or standing in line. Say we happen upon a place where some people are standing in single file. Materially, this is an arrangement of bodies in the spatial environment. To understand this as an instance of queuing or standing in line, we construct a blended mental space (Figure 1). One input to this blend is the perceptual scene—bodies in space—while the other is a conceptual model of service, a "cultural model" intersubjectively shared by members of our society. This conceptual model is based on the principle that people receive service in the order in which they arrive, as stated in the maxim "first come, first served." The model includes ordered slots and a progression toward the experience of receiving service. "Cross-space" mappings link the perceptual scene with the conceptual model: each body is mapped to an ordered slot, while the path of motion of the bodies is mapped to the path of progression toward service. In the blended space, the arrangement of bodies encodes the order of arrival and thus the prescribed or-

der in which people are to be served. Because the bodies anchor the blended space, we are able to reason about who is to receive service when simply by shifting our gaze from person to person, perhaps even counting aloud as we compute our own place in the queue. With the anchored blend in mind, we can act directly on the world to carry out such a computation.

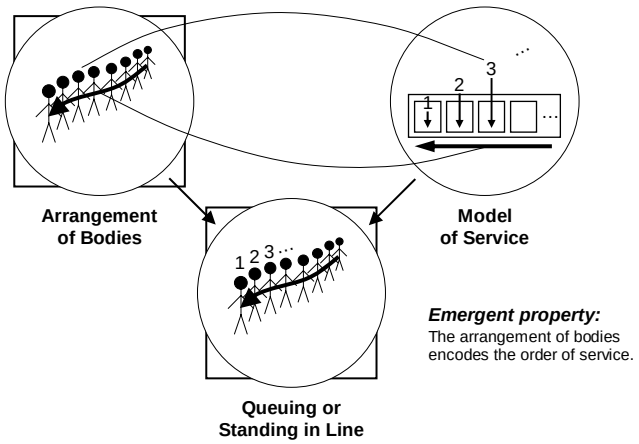


**Figure 1.** The Queuing or Standing in Line blend. The arrangement of bodies anchors the conceptual blend used to determine order of service. (Adapted from Hutchins 2005.)

Let us elaborate on Hutchins' example. Say that a person from a foreign culture happens upon the scene and this person's culture does not incorporate the practice of standing in line. The newcomer needs some guidance. An experienced participant acts as teacher and uses talk, gestures, and other actions to help the newcomer interpret the scene in an appropriate way so that the newcomer can succeed in being served. To understand and behave appropriately, the newcomer must activate—or develop—the requisite conceptual model, map it appropriately to the present scene, and use the blended space and its associated network to generate correct inferences of the relevant form. The expert acting as teacher tries to prompt and shape these conceptual operations through specific talk and actions. What this hypothetical example shows is that instructional discourse is likely to reveal the processes of conceptual mapping and blending. These processes are rapid, automatic, and generally invisible in expert performance, but they become slower, more sequential and controlled, and more directly observable in the interactions between teacher and learner. Instructional discourse opens conceptual mapping and blending to scrutiny—but only if we use a unit of analysis broad enough to capture all of the relevant components.

## Analyses of instructional discourse

With these three key ideas in mind, let us turn our attention to specific examples of instructional discourse. The examples presented here are drawn from a recent study of time-telling artifacts and practices and how these practices are perpetuated through instruction (Williams 2004). A centerpiece of that study was close analysis of specific lessons in clock-reading. We will use excerpts from two lessons taught on consecutive days in a 1st-grade class to illustrate the power of mental space analysis in uncovering how instruction works. In the first excerpt, the teacher helps the students construct a conceptual blend they will use to read "quarter past" times. In the second, the teacher elaborates that blend with paths of motion and present and future states as she prepares the students to read "quarter till" times.

*Building the Clock Quarters blend*

The first excerpt is shown in Transcript 1 (in the Appendix). Because we are including gesture and manipulation of objects in the unit of analysis, the transcript includes both speech and annotated images of activity. The format, adapted from Goodwin (2003), presents speech in the conventional form used in conversation analysis: text with indications of vocal emphasis, pause length, overlapped speech, and so on (details of the transcription conventions are described in the Appendix). Boxes around speech are linked to images of co-occurring activity. In the images, gestures are annotated in red and manipulations of objects in blue; these appear gray in the printed chapter.

Looking at the structure of the discourse, we see several distinguishing characteristics. The teacher does nearly all of the talking, while the learners simply indicate agreement or recognition; these responses provide clues to their understanding. The teacher also glances at the students frequently; we might infer that she is checking for signs of understanding or confusion, an inference supported by her verbal prompts (e.g., "right?" in lines 14 and 25). Looking at the teacher's speech, we see that she speaks in short, distinctly separated utterances; each utterance is a simple clause or phrase ending with emphasis on a key word (*clock*, *shape*, *divide*, and so on) followed by a brief pause. It seems that she is introducing one new piece of information at a time and waiting for it to be processed. We see that even though the teacher controls turn-taking and takes most of the turns herself, the discourse is constrained by the processing capacities of the six- and seven-year-old learners. The teacher's segmented utterances are accompanied by gestures and manipulations of the clock hands and other objects. These play important roles in guiding conceptual mappings onto the clock face and anchoring conceptual elements used to generate time readings. The discourse is also shaped by the teacher's and students' shared history of interaction (this lesson was recorded midway through the school year) and the intersubjective awareness that such a history creates. As an example, this particular lesson draws on knowledge recently developed in the class—the dividing of a circle into halves and then into

fourths—as well as other knowledge shared by the 1st graders, including a basic understanding of shapes, numbers, and counting, and a rudimentary understanding of time concepts (days/hours/minutes). These resources become the conceptual inputs to the blends the teacher is constructing.

To illuminate how the teacher guides the construction of meaning, we proceed through the transcript step by step, detailing how each utterance, gesture, and action contributes to the construction and elaboration of mental spaces and conceptual integration networks. To do this, we diagram the inputs, cross-space mappings, and blends for each line of the transcript, and we identify which elements are being profiled (foregrounded or highlighted) at each moment in the discourse. Space limitations preclude us from walking through the complete analysis here, but an abbreviated account will provide the basic insights (more detail can be found in chapter 5 of Williams [2004], while a focused analysis of the role of gesture in guiding conceptual mapping can be found in Williams [in press]).

In line 2 of the transcript, the teacher lifts an object and places it in her lap while saying "if I take my clock" (Figure 2). The co-timed speech and action map "clock" onto the object the teacher is holding. This object is not a clock: it does not keep time. Instead, it is a specially crafted teaching tool made to look like a clock face with hands the teacher can easily manipulate into different configurations. The teaching tool (hereafter called a "teaching clock") anchors a "Clock" blend, a mental space in which the students see the object as a clock and make inferences accordingly. If they fail to do this, they will miss the point of the entire lesson.

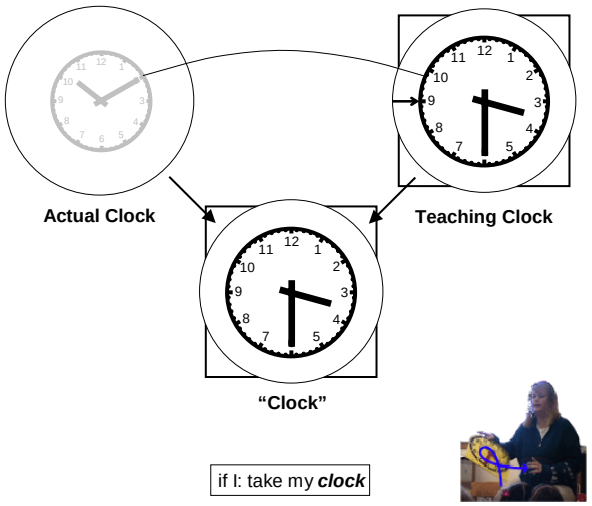


**Figure 2.** The Clock blend. The teaching artifact is seen as a clock.

In line 6, while saying "same circle shape," the teacher traces a circle around the perimeter of the teaching clock (Figure 3). The tracing gesture starts at the top

of the teaching clock, proceeds in steady motion in a clockwise direction (continuing after the end of the utterance), and ends when it reaches the top of the clock again. Goodwin (2003) points out that a trace has both indexical and iconic components. From our perspective, the indexical component highlights the physical structure that is to anchor the conceptual element, while the iconic component outlines the conceptual element that is to be mapped to that anchor. The gesture superimposes the "circle shape" profiled in the teacher's speech onto the band around the perimeter of the clock face. The gesture guides the mapping process, but it is the interrelation of that gesture with the speech and with the environmental structure that actually sets up the mapping. For the remainder of the transcribed excerpt, the clock band anchors a conceptual circle.[1]

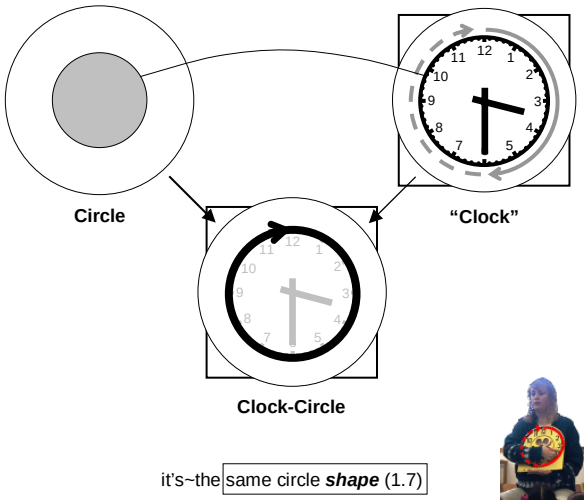


**Figure 3.** Building the Clock Quarters blend (1). Mapping a circle onto the clock face.

Next, the teacher manipulates the teaching clock into a *non-clock* state, forcing the short hand straight up while holding the long hand straight down (Figure 4). Why form a configuration that disrupts the Clock blend? The speech and subsequent tracing gesture ("divide it…up and down here" [lines 8-10]) clarify what is happening. By aligning the hands in this way, the teacher prepares a material anchor for a conceptual element: a vertical dividing line. She then uses a mapping gesture (a trace coordinated with speech) to superimpose the conceptual di-

[1] The circular tracing gesture also enacts a path of motion important to time-telling, namely the path of the long hand through a single clock hour. This conceptual content is not described in the accompanying speech. Other analyses show similar instances of gestures adding path structure not profiled in speech. In some cases, the structure enacted solely in gesture is incidental; in others, it is obligatory to correct understanding. For more discussion, see Williams (in press).

viding line over its material anchor. The hands fuse into a single, stationary element in the blended space.

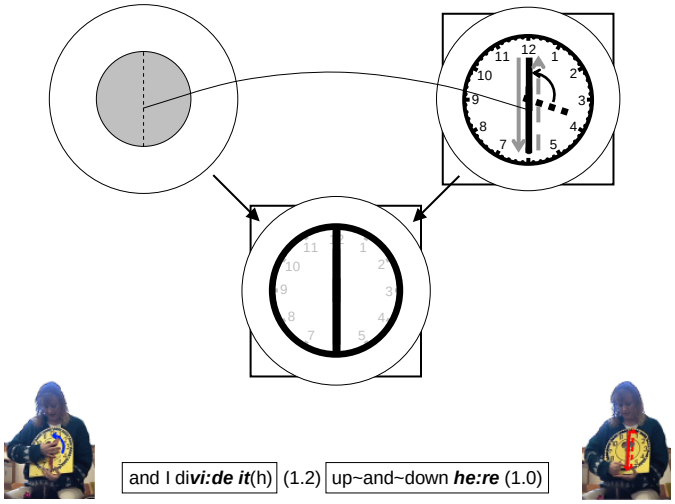


**Figure 4.** Building the Clock Quarters blend (2). Preparing a material anchor and mapping the vertical dividing line.

The teacher's next utterance, "divide it into halves, right?" (line 14), calls attention to the shapes outlined by the conceptual circle and dividing line: halves of a circle. The teaching clock with its unusual hand configuration anchors the part-whole structure of this Clock Halves blend (Figure 5).

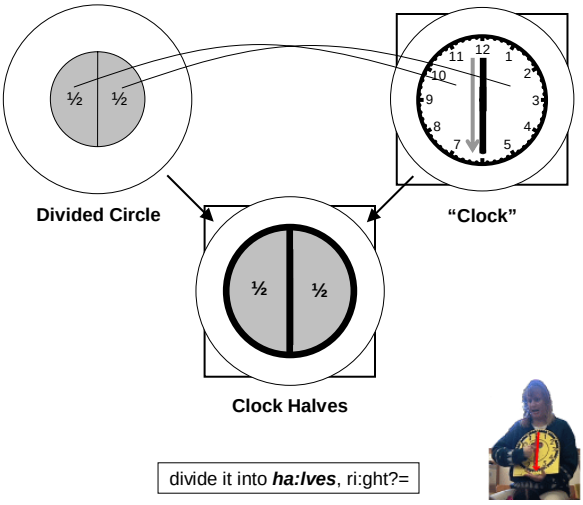


**Figure 5.** Building the Clock Quarters blend (3). Profiling the regions bounded by the conceptual circle and dividing line.

In lines 18-20, the teacher moves closer to her conceptual destination, introducing the idea of dividing the clock face into quarters as she picks up a pointing stick and places it horizontally across the clock face (Figure 6).

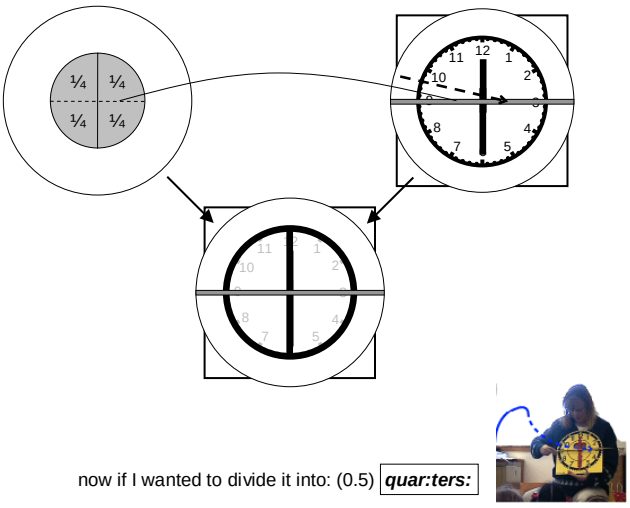


**Figure 6.** Building the Clock Quarters blend (4). Preparing a material anchor for the horizontal dividing line.

Again she has prepared a material anchor for a conceptual element, and we expect her to trace a horizontal dividing line over the anchor she has prepared. In fact, she does this, but in a very interesting way. Because her hands are occupied, she traces the line with her eyes, fixing her gaze on the point where the stick crosses the *9* and then tracing with her gaze along the stick to the point where it crosses the *3* (Figure 7); this eye-trace is accompanied by the utterance "we go from the nine to the three, right?" (lines 22-27), which describes the path she is tracing. The indexical component of the trace picks out the portion of the pointing stick that is to act as material anchor, while the iconic component of the trace superimposes the horizontal dividing line onto this anchoring structure.

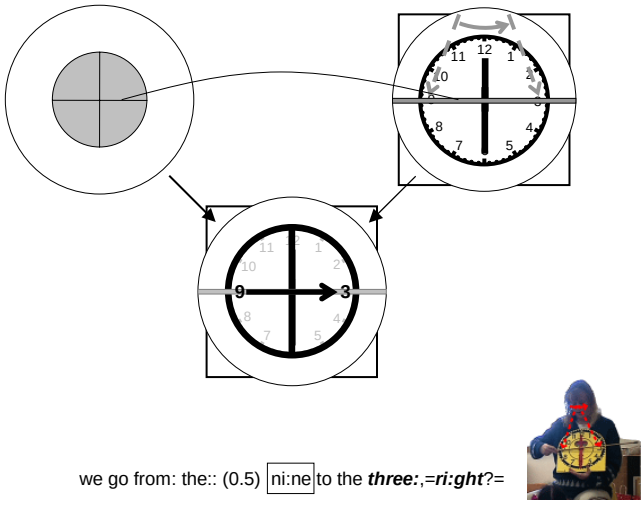


**Figure 7.** Building the Clock Quarters blend (5). Mapping the horizontal dividing line onto the pointing stick anchor.

The teacher has already cued the idea of quarters (line 20), and her next pair of utterances (lines 30-31, analogous to line 14) calls attention to the shapes defined by the circle and dividing lines: the four quarters of a circle (Figure 8). Here the teacher executes an eye-point, glancing at each part in turn as she says "four equal parts."

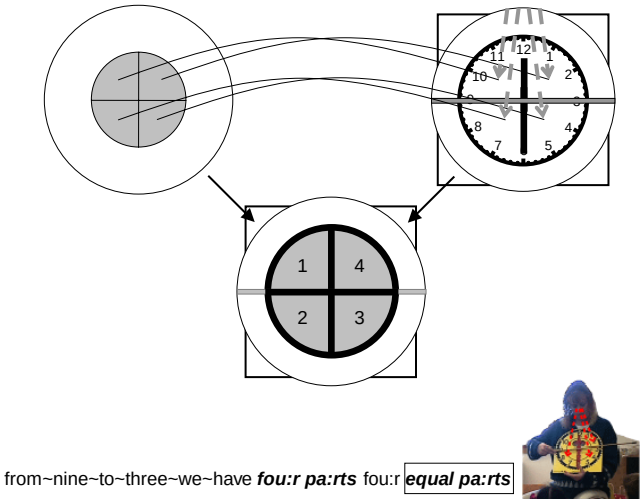


**Figure 8.** Building the Clock Quarters blend (6). Profiling the parts bounded by the conceptual dividing lines while pointing to each part with the eyes.

Finally, the utterance in line 33 ("on our clock") brings the original clock input from line 2 back into profile, completing the Clock Quarters blend (Figure 9).

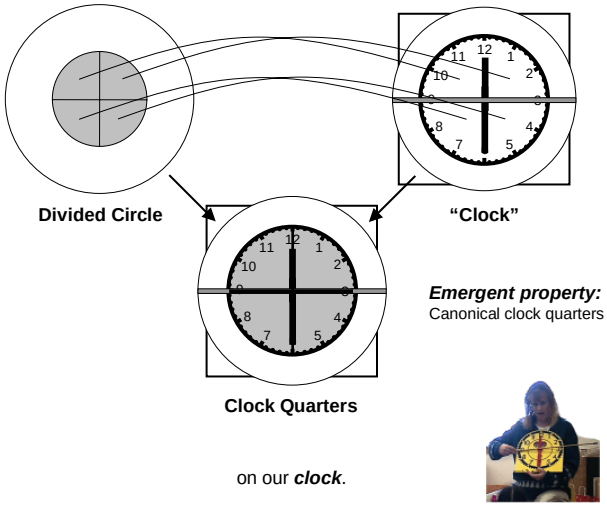


**Figure 9.** Building the Clock Quarters blend (7). Construing the mapped quarter circles as quarters of the clock face.

The Clock Quarters blend has an important emergent property. The quarters of the clock face support a specific way to name times: as a quarter past or a quarter till the hour. In the next part of the lesson (not included here), the teacher associates the label "a quarter past" with the upper right clock-quarter. She then has the students practice naming times such as "a quarter past nine." If the teacher has succeeded in guiding the students' conceptualization, then when the long hand points to the *3* the students will "see" the Clock Quarters blend, even though some of the anchoring structures—the pointing stick and the vertically aligned clock hands—are absent or otherwise employed. In order for the students to use the blend to generate the "quarter past" time component, the Clock Quarters blend must be stable enough that the whole structure can be anchored solely by the clock face with the long hand pointing to the *3*. With repeated use, the blend becomes so well entrenched that it is automatic. In short, it becomes a conceptual model.[2]

The example described above details how the teacher orchestrates the construction of a materially anchored conceptual blend used in one form of time-

[2] Shortcuts to reading the time as "a quarter past" are possible and may be likely: the students can succeed simply by associating the label "quarter past" with the long hand pointing to the right or at the *3* rather than seeing the clock face in terms of the Clock Quarters blend. This impoverished understanding limits the inferences that can be generated. For more discussion, see chapter 6 of Williams (2004).

telling. The orchestration involves speech activating conceptual models and profiling elements while co-timed gestures couple these elements with structures in the environment (see Goodwin [2007] for a relevant discussion of environmentally coupled gestures). If the students have succeeded in following these thirty seconds of guided conceptualization, they should have an active Clock Quarters blended mental space anchored by the face of the teaching clock and linked to divided-circle and clock inputs. This conceptual integration network can be used to generate quarter-hour components of relative time readings, including "a quarter past," "a quarter till," and "half past."

At its present state of development, the Clock Quarters blend is static. It has part-whole structure: a clock-circle made up of four quarters arranged in a canonical configuration. A verbal label ("a quarter past") has been associated with the upper-right quarter. The next day's lesson elaborates this blend by adding motion to the conceptualization.

*Building the Clock Quarters Motion blend*

The goal of the second lesson is to read times as "a quarter till." The lesson begins by recalling the Clock Quarters blend, but then the teacher adds mental spaces for present and future states to the conceptual integration network. Why she does so is not immediately obvious. Why not simply proceed by analogy and associate the label "a quarter till" with the upper-left clock quarter? The reason for the change in conceptualization emerges toward the end of the excerpt, which is shown in Transcript 2 (in the Appendix).

In lines 1-6 the teacher re-establishes the Clock Quarters blend by verbally reminding the students ("remember the quarters were…") and resetting the material anchors. Her initial placement of the pointing stick across the face of the teaching clock recalls the previous day's lesson but sets up a disanalogy between the misaligned clock hands and the vertical dividing line they anchored previously. The teacher solves this mapping problem by removing the pointing stick and realigning the hands vertically, this time with the long hand straight up and the short hand straight down, a reversal that is irrelevant since the hands become a single vertical divider in the blend. The teacher then replaces the pointing stick across the clock face, completing the anchoring of the Clock Quarters blend. As she resets the anchors, the teacher calls attention to where the dividing lines intersect the clock dial: the *12* and the *6* (line 4), and the *9* and the *3* (line 6). These are important because they can be used as landmarks to anchor the dividing lines after the pointing stick is removed and the clock hands are shifted to a time display.

Next, the teacher begins a new phase of instruction. The first part of line 8 ("now what if…") cues a mental space for a hypothetical situation (Figure 10). Lines 8-12 describe that situation, filling in the elements of the new mental space.

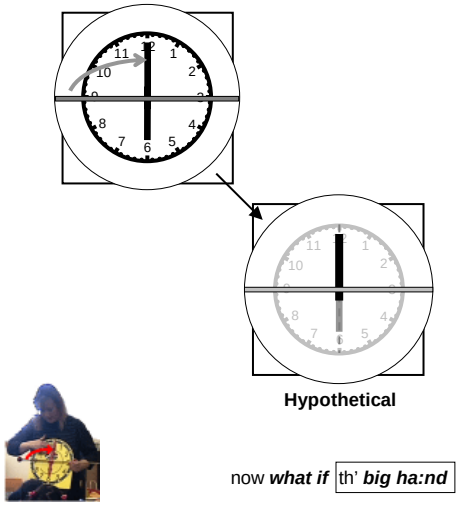


**Figure 10.** Building a conceptual integration network to read ‘a quarter till’ (1). Cueing a space for a hypothetical situation and profiling the long hand in that space.

“The big hand” (line 8) profiles the object the teacher touches: the long hand on the teaching clock. “Moved all the way around to the nine” (lines 10-12) describes motion along a path toward a destination. The teacher enacts this motion by moving the long hand from its present position (pointing straight up with its tip over the *12*) steadily around the teaching clock in a clockwise direction until the tip of the long hand is directly over the *9*, where she releases the hand (Figure 11). This motion description and its enactment add another structuring element to the ongoing conceptualization: a *source-path-goal* image schema (Johnson 1987). The basic elements of a source-path-goal schema are a moving object (trajector), a starting point (source), a series of contiguous locations occupied by the trajector as it moves (path), and a destination or endpoint (goal). The trajector moves along the path from source to goal, and at any given moment it occupies some position along the path. In this instance, the trajector is the tip of the long hand—its most salient and freely moving part. The path begins at the *12* and proceeds clockwise around the clock dial. The *9* has been profiled as the goal, but we will see this profile shift in a moment, construing the *9* as the present position and some other location as the goal.

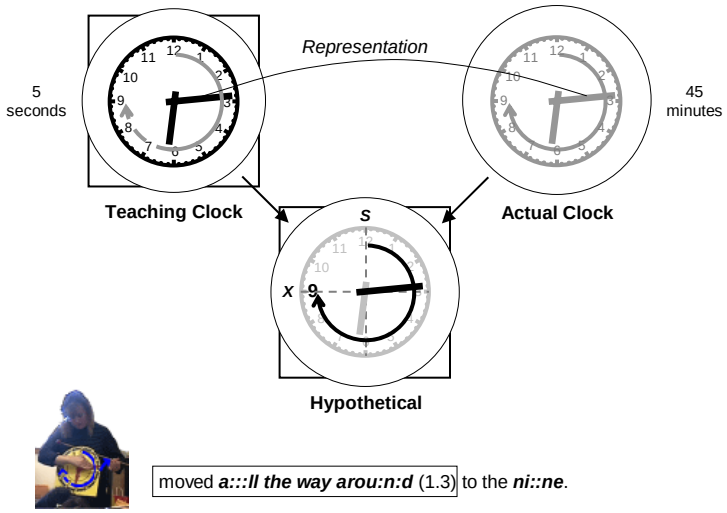


**Figure 11.** Building a conceptual integration network to read 'a quarter till' (2). Defining a path of motion and compressing time in the blended space.

When the focus shifts from the Clock Quarters blend to the Hypothetical space, the teaching clock hands change anchoring functions. They are no longer to be seen as a vertical divider; now they are to be seen as clock hands moving with the passage of time. This is the familiar Clock blend from the start of the previous excerpt, the one in which the teaching clock represents an actual clock. The passage of forty-five minutes on an actual clock has been enacted on the teaching clock in a span of five seconds. This significant scaling of time is an example of the kinds of compressions that occur in blended spaces.[3]

Next, the teacher repeats her description of the hypothetical clock hand motion ("moved all the way around to the nine" [lines 13-14]) as she sets down the pointing stick and grasps the teaching clock at the *9*, the present position of the long hand. She then asks "how far is it until it gets up here?" while tracing a path from the *9* to the *12* (line 16). The first part of the question ("how far is it") asks about distance, not time, continuing the path description from the previous utterance. The second part of the question ("until it gets up here?") cues a Future space in which the long hand points again at the *12* (Figure 12). This second part overlaps with a tracing gesture that mimics the pace, direction, and steadiness of the clock-hand motion she has just enacted. These commonalities promote a construal of the gesture as continuing that motion. While the teaching clock anchors

[3] Blends compress diffuse elements from diverse inputs into an integrated scene at human scale—the scale at which we are used to interacting with the world. See Fauconnier and Turner (2002) for discussion of common patterns of compression and the principles that govern blending operations.

the present state, the tracing gesture leads to the future state. The path has been redefined as extending from the *12* around the clock clockwise to the *12* again, with 9 being the present position. This path corresponds to the passage of a single clock hour, a correspondence which the teacher does not mention.

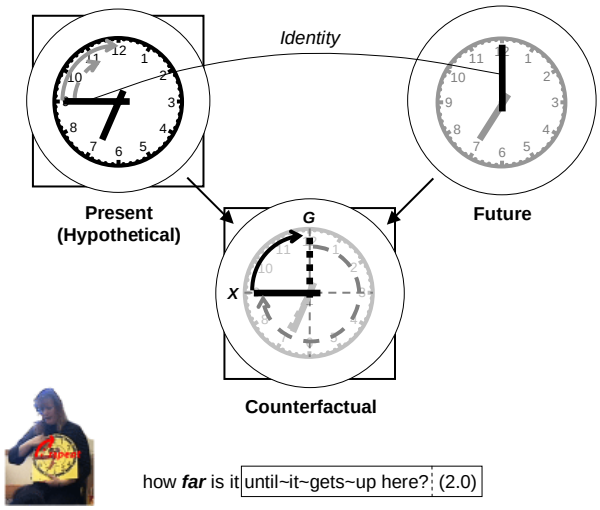


**Figure 12.** Building a conceptual integration network to read 'a quarter till' (3). Asking about the portion of the path yet to be traversed and indicating the goal.

Both the Present-Hypothetical space in which the long hand points at the *9* and the Future space in which the long hand arrives at the *12* are inputs to the blend shown in Figure 12. In the blended space, the tip of the clock hand is a trajector moving along a continuous circular path of motion clockwise from *12* to *12*. The trajector has traversed the portion of the path from the source (*12*) to its present location at the *9*; it still needs to traverse the portion from the *9* to the goal (*12*). Time is compressed in the blend, but here it is syncopated rather than scaled: the present and future positions of the clock hand are co-present in the blend. For this reason, the blend is labeled Counterfactual. In this Counterfactual blend, these two profiled elements—the present and future positions of the long hand—share the common conceptual base of the clock dial, and they stand in relation to one another in a way that will support reading times as "a quarter till."

This Counterfactual blend has both material and imagistic anchors. The common conceptual base, the clock dial, is anchored by the face of the teaching clock; this was established at the start of the first lesson. The first profiled figure, the present position of the clock hand, is anchored by the hand on the teaching clock. The second profiled figure, the future position of the clock hand, has no material anchor. Instead, it is anchored by the mental image that resulted from imagining the clock hand moving from the *9* to the *12* as guided by the teacher's gesture. This superimposition of an imagined structure onto a visually perceived structure is an example of "situated seeing," a way of seeing in the present situa-

tion that supports performance of the task at hand. We have already encountered one example of this: seeing the Clock Quarters blend even after the pointing stick has been removed and the clock hands have been moved to another configuration. Of course, an imagistic anchor lacks the durable presence of the material anchor from which it is derived, but it serves a similar function: temporarily fixing an element in the blended space while inferences are generated.

Returning to the excerpt, we see that no students respond to the teacher's question ("how far is it until it gets up here?") during the next two seconds (line 17). The teacher then redescribes the path from the present to the future state ("moves from here to here" [lines 19-21]), but this time instead of gesturing over the face of the teaching clock, she leans over and gestures over four quarter circles displayed on a felt board (Figure 13). She touches the upper-left quarter circle at the point that corresponds to the location of the *9* on the clock face, and then she traces a path along the upper edge of this quarter circle to the point that corresponds to the location of the *12*. A student raises her hand, is called on by the teacher (line 24), and replies "one quarter or one fourth" (line 26), an answer which the teacher accepts (line 27).

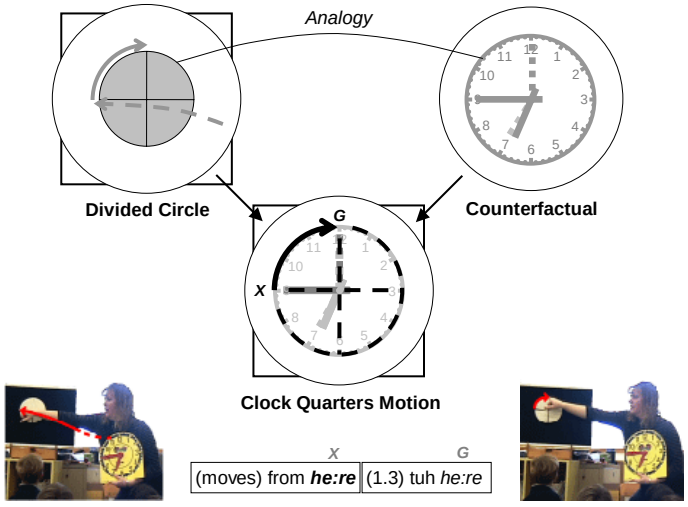


**Figure 13.** Building a conceptual integration network to read 'a quarter till' (4). Switching anchors from the clock face to the felt board display and tracing a path along the upper-left quarter circle.

What is happening here? When the students fail to respond to the teacher's question, she repeats her description but gestures over a different object. In other words, she switches anchors. The felt board display anchors the conception of quarter circles; this "divided circle" was one of the inputs to the original Clock Quarters blend. To instantiate the Clock Quarters blend using this new material anchor, the students must map in the opposite direction: from the clock face to the felt board display. The teacher guides this mapping by pointing with her pinky to

the location on the felt board display that is the counterpart to the present position of the clock hand. She then executes a tracing gesture exactly analogous to the one she has just performed on the teaching clock, stopping at the location on the felt board display that is the counterpart to the future position of the clock hand. The strategy of shifting anchors to highlight a different conceptual input makes sense here because the construction of a more complex blend with motion from a present to a future state has drawn focus away from the Clock Quarters blend that was reactivated at the start of the excerpt. Gesturing over the felt board display shifts attention to the divided circle input and brings the quarter circles back into profile, restoring the Clock Quarters blend but with the addition of a path of motion and a present position along that path. The result is a more complex Clock Quarters Motion blend, one that incorporates the divided circle, the clock face, a path of motion around the clock from *12* to *12*, and present and future positions of the trajector moving along that path. With the addition of the source-path-goal schema defining the path of motion, the static part-whole conceptualization of the previous lesson has been transformed into a dynamic, motion-based conceptualization. In this richer conceptualization, the quarters demarcate portions of the path traveled by the long hand as it moves around the clock.

At the time when the student is responding to the teacher's question, she has two distinct material anchors available to her in the environment: the teaching clock and the felt board display (Figure 14). The video-recording does not provide evidence of where she looks, and the teacher simply looks at the student without interacting with any objects during the student's response.

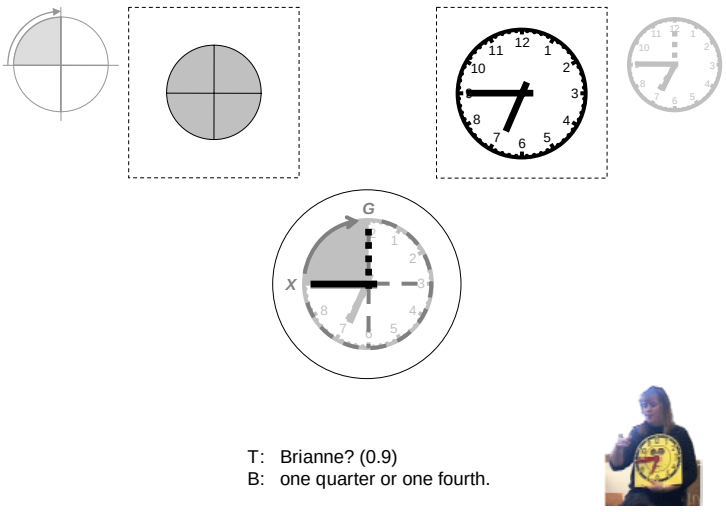


**Figure 14.** Building a conceptual integration network to read 'a quarter till' (5). Material anchors are available for both inputs to the blended space, but it remains for the student to do the integration.

Once the student has responded, the teacher repeats “it’s a quarter” (line 27) while re-executing the tracing gesture she just performed on the felt board display but now again performing it on the teaching clock (Figure 15). This gesture can be construed in two ways at once: as indicating the present-to-future movement of the long hand from the *9* to the *12*, and as tracing the edge of the upper-left clock quarter. In the blended space, the long hand has one quarter of its path left to traverse before it reaches its goal.

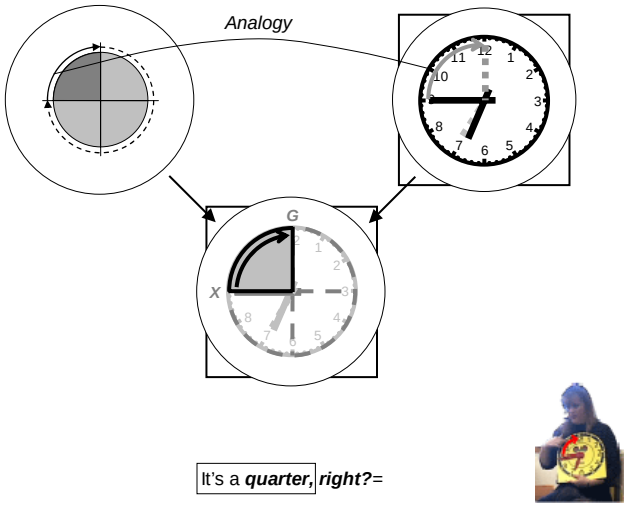


**Figure 15.** Building a conceptual integration network to read ‘a quarter till’ (6). Profiling the portion of the clock face to be traversed as the long hand moves from its present position to the goal.

In line 28, the teacher repeats the gesture quickly and only partially while saying “it’s a quarter of the clock,” explicitly profiling the Clock Quarters input to the more complex conceptual blend she has constructed: the Clock Quarters Motion blend (Figure 16).

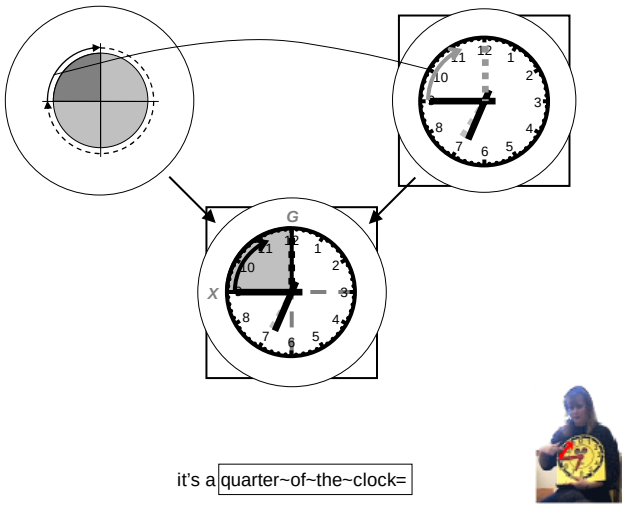


**Figure 16.** Building a conceptual integration network to read 'a quarter till' (7). Profiling the Clock Quarters input to the new Clock Quarters Motion blend.

At this point, the discourse shifts from constructing the blend to using the blend to read the time. In lines 29-33, the teacher says, "So we say it's a quarter till seven. It's a quarter till seven." Each time she says "quarter till seven" she executes the same series of gestures: she traces from the *9* to the *12* as she says "quarter," pauses with her finger on the *12* as she says "till," and then jumps her pointing finger to the *7* on the word "seven" (Figure 17). This series of gestures provides a clue as to why the teacher has gone to the trouble of adding motion to the conceptualization: to motivate correct reading of the hour component (the *7*).

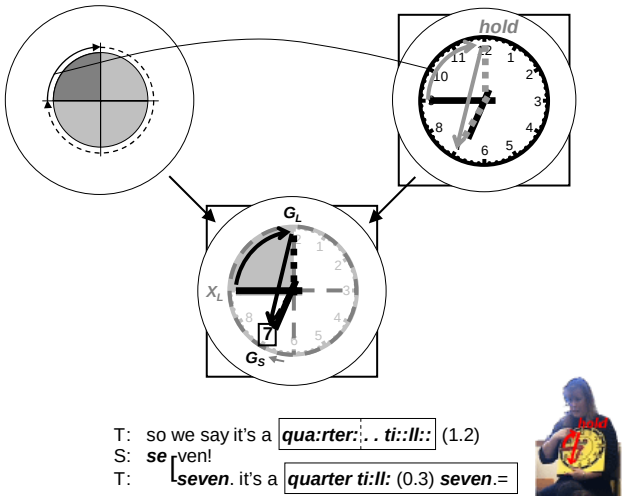

**Figure 17.** Using the conceptual integration network to read 'a quarter till.' Tracing the path of the long hand to its goal and then pointing to where the short hand will be in the goal state.

In the previous day's lesson, when students read times in both absolute and relative forms as "three fifteen" and "a quarter past three," there was no difference in the hour portion of the readings. Indeed, the teacher said nothing at all about how to read the hour, and the students appeared to have little difficulty. In the current day's lesson, students are reading times as both "six forty-five" and "a quarter till seven." Here the hour portion of the readings differs. In fact, the hour portions of absolute and relative times are read using different image schemas (Williams 2004). For absolute times like "six forty-five," the hour is properly read using a *container* schema (Johnson 1987): if the long hand is contained anywhere in the space between the *6* and the *7*, then the hour is "six," no matter how close the hand is to the *7*, even if it appears to be touching the *7*. Six is the *current hour*, and it does not change until the long hand actually reaches or crosses the *7*. For relative times like "a quarter past six" and "a quarter till seven," the hour is properly read using a *source-path-goal* schema: "past" times are referred to the previous hour (the source), as in "a quarter past six," while "till" times are referred to the upcoming hour (the goal), as in "a quarter till seven." The hour component of a relative time reading is the *reference hour*, a past or future "o'clock" time. For "past" times the current hour and reference hour happen to coincide; for "till" times they do not.

From this we see that adding a path of motion to the conceptualization is important because it motivates the use of the proper schema to read the reference hour correctly. The path of motion of the long hand once around the clock from *12* to *12* coincides with the path of motion of the short hand from one number to the next. If we refer to the future (goal) state of the long hand, as the teacher does in her gestures for "a quarter till," then we should refer to the corresponding future (goal) state of the short hand, as the teacher does when she touches the *7*. If we were to use the static part-whole conceptualization to read "quarter till" times, say by associating the label "a quarter till" with the upper-left clock quarter, then there would be no conceptual connection to the reading of the hour portion, no linking of goal to goal. Of course, we could learn to perform correctly by simply remembering to name the upcoming hour whenever we say "a quarter till," but there would be no particular motivation to do so—in other words, no real understanding. A proper understanding of "a quarter past" should also include the source-path-goal schema, but without a noticeable difference in the output or propensity for error, there is no compelling reason for the teacher to bring motion into the discourse when teaching "quarter past" times.

*Comparing the conceptual integration networks*

The conceptual integration network for the Clock Quarters blend and the elaboration of that network to produce the Clock Quarters Motion blend are depicted in

Figure 18. When we compare the first lesson excerpt with the second lesson excerpt, we see that adding motion to the conceptualization invokes mental spaces for different moments in time, including past (trajector leaving the source), present (trajector at some position along the path), and future (trajector arriving at the goal). Identity mappings link the counterparts in these different spaces: trajector to trajector, path to path, and so on. Different time spaces can be blended in a syncopated way, so that present and future states co-exist in the blend, or they can be blended in a scaled way, so that slow processes like clock-hand movement unfold rapidly in the blend. A static blend like Clock Quarters can be a mental image, but a dynamic blend like Clock Quarters Motion is likely to involve mental simulation of unfolding processes. For this reason, motion-based conceptualizations may call upon greater cognitive resources. In terms of cognitive economy, a static conceptualization may suffice to generate relevant inferences in many situations, but a motion-based conceptualization may be called upon when the static one fails to support reasoning in a particular situation. This is, at present, only conjecture, but Figure 18 does demonstrate greater complexity in the conceptual integration network when motion is added.

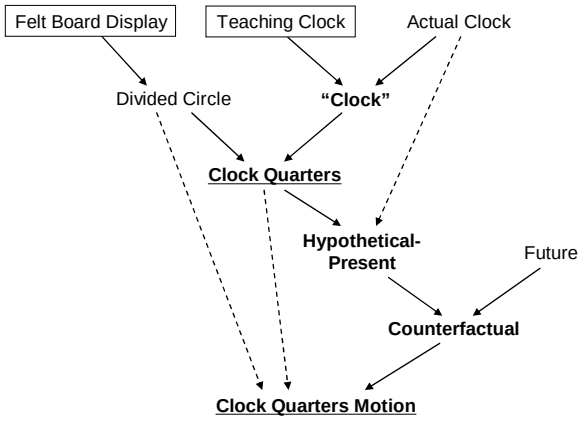


**Figure 18.** The conceptual integration network used to build the Clock Quarters Motion blend. Material anchors are shown in boxes; the sequence of conceptual blends is in bold.

## Discussion

Classroom lessons in time-telling consist of practice reading clock times punctuated by micro-episodes of explicit instruction. The teacher sets times on the clock, calls on students to read them, and provides support (verbal cues, pointing,

leading questions, partial responses, etc.) as needed to scaffold student performance. Embedded in this practice are brief interludes of instructional discourse like the two samples presented here. What happens when the discourse becomes overtly instructional? The balance of participation shifts so that the teacher does most of the talking and acting while the students watch and signal agreement or confusion. The teacher directs the students' attention to particular structures in the environment and provides information as to how those structures are to be construed or acted upon.

This is a fine high-level explanation, but we would like to deepen our understanding of what is happening; the mental space analysis allows us to do that. In the analyses presented in this chapter, we see how the teacher's talk, gestures, and manipulations of objects prompt the systematic construction of conceptual integration networks that are used to generate portions of time readings. Talk serves primarily to cue space-building (including spaces for alternate times and hypothetical or counterfactual states), to activate conceptual models that frame those spaces, to profile elements, and to prompt other mapping and blending operations. Manipulations of objects and gestures over those objects come to the fore when the blended space being constructed is related to interpreting the state of the environment, as in reading a clock. The teacher uses pointing and tracing gestures to highlight environmental structures at moments in the discourse when related conceptual elements are being profiled in speech. These coordinated gestures and utterances prompt mappings that link conceptual elements with material anchors. The teacher also manipulates objects to prepare anchors just before executing gestures that guide the mappings. Through these means the teacher builds anchored blends, linking mental spaces with the world.

Once an anchored blend has been constructed, the teacher can gesture over the anchoring structures to generate an inference, as she did when she traced a path on the clock face to read "a quarter till seven," or she can manipulate the anchoring structures directly to enact a simulation in the blended space, as she did when she moved the long hand around the clock from *12* to *9* to simulate the elapsing of three quarters of an hour of clock time. As these examples show, anchored blends are used to do cognitive work.

Finally, among other things, the mental space analysis presented in this chapter helps us distinguish phases in the instructional discourse when conceptual blends are being constructed or elaborated and when those blends and their associated networks are being used to perform tasks such as reading the time. In the construction phase, the teacher's talk, gestures, and actions guide conceptual mapping and blending; in the performance phase, they guide the generation of task-relevant inferences. In both phases, the teacher actively guides conceptualization.

## Conclusion

Much can be learned from acting on the environment and experiencing the outcomes of our actions. Much can be learned from observing and imitating the behaviors of others. Such forms of learning fall short when it comes to sustaining practices like time-telling. Because reading a clock is so complex and because expert clock-reading unfolds invisibly, trial-and-error and imitation are unlikely to produce the conceptual integration networks the novice needs to succeed. For this kind of learning, we humans rely upon guided conceptualization: talk, gestures, and actions that prompt and shape the conceptual operations of others. Guided conceptualization is a hallmark of instruction, a central means of sustaining the cognitive sophistication of our species. Mental space analysis provides insight into this distinctly human process.

## Acknowledgments

I am deeply indebted to Gilles Fauconnier, Edwin Hutchins, and Charles Goodwin for inspiration, advice, and encouragement of this research, and to the Spencer Foundation for a dissertation fellowship that helped support the initial study.

## References

Fauconnier, G. 1994. *Mental Spaces: Aspects of Meaning Construction in Natural Language*. Cambridge: Cambridge University Press. (First published in 1985 by the MIT Press, Cambridge, MA.)

Fauconnier, G. 1997. *Mappings in Thought and Language*. Cambridge: Cambridge University Press.

Fauconnier, G. and Turner, M. 1998. "Conceptual integration networks." *Cognitive Science* 22 (2): 133-187.

Fauconnier, G. and Turner, M. 2002. *The Way We Think: Conceptual Blending and the Mind's Hidden Complexities*. New York: Basic Books.

Goodwin, C. 2003. "Pointing as situated practice." In *Pointing: Where Language, Culture, and Cognition Meet*, S. Kita (ed), 217-242. Mahwah, NJ: Lawrence Erlbaum.

Goodwin, C. 2007. "Environmentally coupled gestures." In *Gesture and the Dynamic Dimension of Language*, S.D. Duncan, J. Cassell and E.T. Levy (eds), 195-212. Amsterdam: John Benjamins.

Hutchins, E. 2005. "Material anchors for conceptual blends." *Journal of Pragmatics* 37 (10): 1555-1577.

Hutchins, E. and Palen, L. 1997. "Constructing meaning from space, gesture, and speech." In *Discourse, Tools, and Reasoning: Essays on Situated Cognition*,

L.B. Resnick, R. Säljö, C. Pontecorvo and B. Burge (eds), 23-40. New York: Springer-Verlag.

Johnson, M. 1987. *The Body in the Mind: The Bodily Basis of Meaning, Imagination, and Reason*. Chicago: University of Chicago Press.

Williams, R.F. 2004. *Making Meaning from a Clock: Material Artifacts and Conceptual Blending in Time-Telling Instruction*. Ph.D. diss., University of California, San Diego.

Williams, R.F. In press. "Gesture as a conceptual mapping tool." In *Metaphor and Gesture*, A. Cienki and C. Müller (eds). Amsterdam: John Benjamins.

## 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)

(0.7)

Teacher: if I: take my ***clock***

(0.6)

(S?): (( *whoop* ))

(0.6)

Teacher: it's~the same circle ***shape***

(1.7)

and I di***vi:de it***(h)

(1.2)

up~and~down ***he:re***

(0.2)

S1: °half

(0.8)

Teacher: divide it into ***ha:lves***, ri:ght?=

S1: yeah

S2: m-hm yeah

(0.3)

Teacher: now if I wanted to divide it into:

(0.5)

***quarter:s:***

(3.7)

we go from: the::

(0.5)

S+: n ine (( *inaudible* ))

Teacher: ni:ne to the ***th ree:***,=

S4: three!

Teacher: ***ri:ght***?=

S5: ***yea:h***.

(0.5)

Teacher: from~nine~to~three~we~have ***fou:r pa:rts***

fou:r ***equal pa:rts***

(0.4)

on our ***clock***.

(1.9)

## Transcript 2

qtrtill7 (0:50)









1 ... (3.6)
2 Teacher: remember th- ***quarters*** were when it was
3 (2.3)
4 twelve and th' ***six***
5 (1.0)
6 th' nine and the ***three:***.
7 (0.5)
8 now ***what if*** th' ***big ha:nd***
9 (0.7)
10 moved ***a:::ll the way arou:n:d***
11 (1.3)
12 to the ***ni::ne***.
13 (2.2) *((inaudible student))*
14 (°moved) ***a:ll the way*** around to the ***ni:ne***.
15 (0.6)
16 how ***far*** is it until~it~gets~up here?
17 (2.0)
18 S: five
19 Teacher: (°moves) from ***he:re***
20 (1.3)
21 °tuh *he:re*
22 (0.9)




23 S: *((inaudible murmur))*
24 Teacher: °Brianne?
25 (0.9)
26 B: °one quarter or one fourth.
27 Teacher: it's a ***quarter, right?***=
28 it's a quarter~of~the~clock=
29 so we say it's a ***qua:rter:*** (0.4) ***ti::ll::***
30 (1.2)
31 S: ***se***ven!
32 Teacher: ***seven***.
33 it's a ***quarter ti:ll:*** (0.3) ***seven***.=