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Perceptual gestalts in workplace communication

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Abstract

This paper contributes to the growing body of work on the distributed nature of cognition in general and communication in particular. Whereas previous studies have begun to include body orientation and gestural deixis in their analysis of verbal communication, the world in which human agents are embodied is merely taken as ground over and about which the communication takes place. In this study, based on and in extension of my previous research in school science classrooms, I propose to include perceptual modalities for analysing communication, which is therefore, consistent with recent work in situated cognition, understood as distributed across verbal, gestural and perceptual modalities. Detailed analyses of workplace situations are used to support the argument that the unit of analysis for pragmatic studies of communicative action at the workplace should account for all three rather than only one or two of these modalities.

Keywords: Social interaction; Referential practice; Work; Objects

1. Introduction

1.1. Communicating without words

In an ongoing ethnographic study of a salmon hatchery operation, I observed one day an unfamiliar team of three women marking coho salmon. Two women (Marie, Belle) operated identically looking devices into which they inserted the young salmon that were sliding to their station by means of slanted troughs into which the third woman (Sarah) had placed them. She appeared to put about the same number of coho into each of the two channels, but retained apparently very small fish that ended up in a bucket. As I watched the silently working women, Belle returned a fish into the trough so that it ended up with Marie. Sarah said, 'Oh, one of those'.

When I asked why she had placed this fish into the trough leading to the other women, Belle said that it had been too small for her device and that Sarah, who was sorting the fish according to size, had made an error. Because it was not evident that there were size differences, even from my position of standing less than a meter beside her, I asked Sarah to teach me, expecting that she would *tell* me how to distinguish the fish. Sarah said she couldn't tell me but that I should stand next to her and watch. She then sorted the next tray of fish very slowly so that I could, standing immediately next to her, see the fish more closely. Slowly I began to notice differences and soon I was able to predict where a fish would go with 90% accuracy.

In this situation, Sarah had taught me to classify the coho in fish that was too-small-to-be-marked, 'small', and 'large'. In teaching, she 'communicated' her understanding of the classification, and yet could not *tell* in so many words how to distinguish the fish other than by looking and seeing. More so, in returning the fish, Belle had not only placed the fish into Marie's trough but also communicated (without telling) that the fish was too small. Why this was the case has to be (perceptually) found in the object. That is, Marie perceived the fish to be too small for her device; the fish itself carried this information. The fish and her action of returning it to the other trough communicated, both to Marie and Sarah that it had been too small. In the next turn, Sarah commented that the fish was 'one of those'. In fact, we can hear their silence—or talk about unrelated issues—as communicating that work is going just fine and that there is no trouble.

In my work at the hatchery, I have recorded many similar examples. In one situation, when I asked fish feeders and fish culturists how they determined when to release the coho smolt, they told me that they could see it. They threw some food into the pond and told me to 'look how they swim'. On another occasion, I took a trip with fisheries biologist into the estuary near the hatchery and found myself in a situation having to learn how to classify and count different types of fish (stickleback, coho, sockeye, chum). Here, too, much of what it takes (a beginner) to distinguish a stickleback from a young

salmon or to tell that a pond of coho was ready to be released could not be said in so many words ('It doesn't look like a salmon', 'look how they swim'). Yet their decisions on how to categorise and when to release the coho were based on these perceptual gestalts. I had to watch and learn to make perceptual distinctions even though they resisted verbal description. My work among scientists, technicians and environmental activists shows that such perceptual gestalts are important aspects of communication outside of hatcheries as well. Time and again I had occasion to observe that communication at work relies on perceptual gestalts. To understand laboratory communication, therefore, I had to begin not only listening to the utterances and watching the gestures, but also to learn the significant gestalts that members in the situation took for granted, as 'going without saying'.

1.2. Towards a comprehensive analysis of communication at work

Undoubtedly, linguistic resources are crucial to the construction and reconstruction of social order. Many researchers in discourse analysis (e.g., Edwards and Potter, 1992) and pure conversation analysis (e.g., ten Have, 1999) have come to focus exclusively on the texts people produce to the exclusion of other resources that are employed alongside, and are frequently intertwined, with the linguistic resources. Such additional resources have been at the centre of more recent studies, particularly by those who engage in pragmatic studies of interactions in the workplace (e.g., C. Goodwin and M. Goodwin, 1996; Heath & Luff, 1996). Thus, gestures (e.g., C. Goodwin, 1995; Ochs et. al., 1996) and body orientation (e.g., Heath, 1986; Heath & Luff, 2000) and their interaction with verbal productions have been shown to contribute in non-negligible ways to the intelligibility of communication at work.

Despite these tremendous advances in pragmatic analysis of workplace interactions, the analysis of communication at work still appears to be incomplete because the context itself can carry information that contributes the shared understanding of collaborators.

For example, graphic marks produced during a meeting are sign forms that neither in the utterances or gestures but still constitute turn-taking units and therefore resources to the interaction (Streeck and Kallmeyer, 2001). Important for the present study is the fact that graphic marks are available to interlocutors as perceptual gestalts. Such gestalts also play a role in the formation of gestural representation, which often arises from manipulative and sensing movements of hands and arms that undergo qualitative change to become symbolic and function independent of the materials and contexts where they originated (Roth and Welzel, 2001). Thus, when students learn science through laboratory activity, initial 'descriptions' and 'explanations' of phenomena are demonstrations, frequently presented without accompanying words; gestures and words become the predominant means of communication only at a later stage. I therefore suggested that perceptual gestalts constitute an important but insufficiently appreciated sign form in communicative processes (Roth and Lawless, in press-a). Paraphrasing Garfinkel (1996: 17), we might say that perception and its production cannot be separated from public descriptions that our students produced and attended to as joint courses of action. In embodied telling, a seeing member brought into being 'electrical attraction', 'concentrated charges', and 'forces that go across here [a beam]'. What the students achieved is an alignment of the visual field along with the instructions, provided by another, of how to gaze.

1.3. Purpose

The purpose of the present study is to advance and theorise my previous contention of perceptual gestalts as sign forms that take part in communication by drawing on data from science-oriented workplaces such as vision research laboratories, ecological fieldwork, and salmon hatcheries. I show that communication in the workplace is based on the alignment of two contrasting organisational classes of material. One organisational class pertains to perceptual gestalts, the other to language-based and gestural accounting processes that interact with and operate on the perceptual gestalts. In moments of trouble,

verbal and gestural modalities are resources for exhibiting the relevancy, details and composition of optical and conceptual consistency.

2. Talk, gestures, and things ('objets trouvés')

Early language studies restricted themselves to structural or psychological aspects (Duranti, 1985), which has led to a distorted view of language-in-use (Clark, 1996). Throughout the 1980s and 90s, however, researchers increasingly realised that context plays an important part in communication. They realised that 'while there is nothing but the text, not everything that is needed for its analysis is in the text' (Watson, 1992: xv). Body, gesture and context have become recognised to be important resources in human communication (e.g., Duranti and Goodwin, 1992; Goodwin, 1981; Hanks, 1990; Watson and Seiler, 1992). Although some studies have shown the importance of orientation and gaze to successful communication at work (e.g., Goodwin, 1995; Heath and Luff, 1993; Luff and Heath, 1993), the visual conduct of speakers continues to be underrepresented in the academic discussion (Hindmarsh and Heath, 2001).

Even in the absence of entities and events that are being talked about, speakers and listeners make use of verbal and gestural deixis and body orientation (e.g., Haviland, 1998; Roth and Lawless, in press-b). Orientation to objects and events in a setting is even more prevalent when the entities being talked about are not only present and but their salience is taken as shared by the respective other (Roth, 2001). Humans not only do things with things, which gives them symbolic properties but the things in the environment ('objets trouvés') are similarly perceived to have certain affordances (Streeck, 1996) and characteristics that go without saying and therefore have to be neither referred to (deixis) or talked about (Roth, 2000).

The reviewed literature suggests that there are multiple levels at which communication occurs. Semiotics, the science of signs, provides a tool kit for analysing communication at the different levels that are (made) available by the interlocutors for

one another. Clark (1996) suggests that interlocutors create signs by demonstrating a thing (sign = icon), indicating a thing (sign = index),[1] and describing as a type of thing (sign = symbol). In addition, we suggested that the perceptual gestalts of objects also function as signs (Roth and Lawless, in press-a). These different signs constitute different segmentations of the material continuum (Eco, 1984), which are co-ordinated in practical communication.

The perceptual gestalts have shown to play an important role in the early parts of science students' understanding of natural phenomena: objects (objet trouvés) are presented when students are asked to say what they have observed or learned (e.g., Roth and Welzel, 2001). Not only do objects represent themselves, being present in and shape the conversation, but also are interlocutors aware of the presence and of others' awareness. Words, gestures and perceptual gestalts are resources for conducting interaction and communication (Figure 1). In this approach, therefore, the perceptual gestalts of the physical world (in which interlocutors are an integral part) and the objects that it contains are more than indexical ground (e.g., Haviland, 1993) or structuring resources for deictic reference (e.g., Hanks, 1992). In all of the different workplace settings that I researched, perceptual gestalts have shown to be an integral aspect of communication (e.g., Roth and Bowen, 2001b).
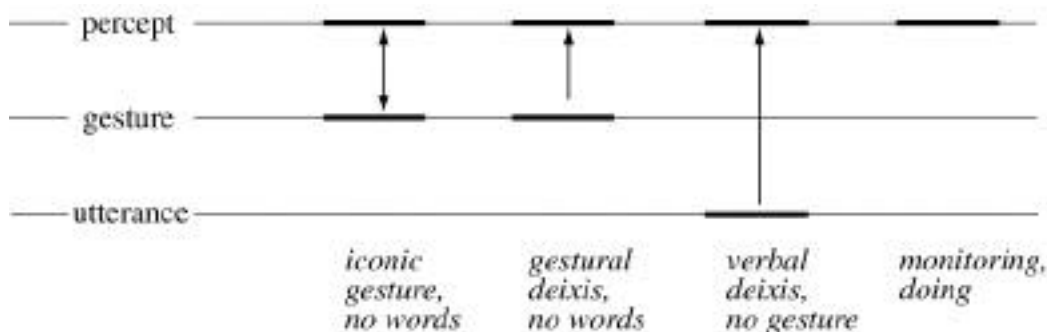

Figure 1. Communication consists of three modalities. These occur individually or in combination and are frequently explicit linked through verbal and gestural deixis.

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[1] Linguists refer to the process of indicating as deixis.

Taken together, the results of previous research indicate that communication is a hybrid that serves, depending on the situation, both instrumental and socio-semiotic purposes. This hybridity has to be taken seriously to understand situated communication because 'it is the way in which the systems are blended, the figurative possibilities of one system once its components are projected onto one another' (Streeck and Kallmeyer, 2001: 488). A priori, there is therefore no analytic asymmetry between the three modalities. If there is an asymmetry between the three modalities, it is part of the situated accomplishment of communication. Thus, whereas there may be a preference for words (written, spoken), gestures, objects and material actions often characterised laboratory conversations especially in moments of uncertainty (Roth and Lawless, in press-a). The situational deployment of different modalities therefore arises from empirical analysis rather than constituting (hidden) suppositions.

3. Materials and analytic method

Over the past five years, I have conducted (together with my graduate students) extensive studies of individuals in a variety of workplaces, but always engaged in activities that involve science. Thus, I have conducted ethnographic research among field ecologists, experimental biologists, environmental activists, and hatchery personnel. Data collection consisted of fieldwork, interviews with staff, and extensive video recording of ongoing activities. In addition, I collected copies of material artefacts generated by the individuals. In all situations, I have participated in the activities themselves, allowing me to experience them as a native. This was especially necessary when individuals could not articulate in so many words just what was relevant in making the perceptual distinctions required in their job.

The materials that I draw on in this article come from three different contexts. The examples that feature in the introduction come from an ongoing research project on the operation of salmon hatcheries and the local and scientific knowledge evident in the

practices of those who work there feeding, capturing and classifying, marking and releasing salmon. Another fragment was culled from a two-year ethnographic project on the production of knowledge in ecological fieldwork. The particular materials used in this article were collected while in the field with a Ph.D. student who collected and researched a lizard species, the life history strategies of which she had proposed as her doctoral research. Classifying and making perceptual distinctions were pervasive in her work as she grappled with issues such as 'Where is the forest edge?', 'What species is this tree?', or 'Is this a rock pile or is it not a rock pile?'

The third set of materials come from an ongoing ethnographic research program in an experimental biology laboratory that focuses on vision in salmonid fish. One of the experiments is concerned with the absorption of light in the different light-absorbing cells (rods, cones) in the retina. Whereas there is only one type of rod, there are four types of cones, distinguished by the colour range in which they maximally absorb (red, green, blue, and UV). The maximum absorption of all cells is not constant in the life history of a salmonid but changes. The advantage of these data over others is that the researchers are jointly oriented to different perceptual fields, which themselves frequently change. This data set provides many opportunities for tracking perceptual gestalts and the production of repair when there appear to be differences between laboratory members in just what was displayed or seen on the monitor.

In all studies, the videotapes were transcribed within hours to a few days on a word by word basis, but without pause length or overlaps. The transcriptions of episodes with apparent theoretical appeal were then enhanced to include those features common to conversational analysis. Transcription, co-ordination, and timing were upgraded by playing the digitised version (using Macintosh iMovie software) of the video at one-half to one-fifth of the normal speed. That is, the enhanced transcriptions included the extent of pauses, overlaps, stresses, and so forth. In addition, representations of the focal situations (e.g., artefacts, drawings, etc.) over and about which conversations took place

were included in the transcripts. Here, these representations are video stills or, when the video quality is low (e.g., shot in the dark), drawings generated from screen display. Because the videotapes were recorded at a rate of 30 frames per second, timing of gestures, speech and perceptual modality and the co-ordination between the three is accurate to within one frame or 1/30th of a second.[2]

This study is aligned with the ethnomethodological and conversational analytic programmes, attempting to reconstruct order through the ways in which the people themselves make this order available to each other. Any setting organises its environment of practical activities to make it 'detectable, countable, recordable, reportable, tell-a-story-aboutable, analyzable—in short, *accountable*' (Garfinkel, 1967: 33, emphasis in original). I therefore assume collaborators to be continually engaged in making salient and available to each other the rational, that is, coherent, consistent, and chosen character of their activity. The difficult classification situations that I observed and recorded among scientists and technicians constitute the kind of breakdown or troublesome situations that Harold Garfinkel used to provoke people to articulate or make visible otherwise their ordinary, everyday 'ethnomethods' for coping with the world. It is in trouble situations, particularly when they collaborate with others, that people make available to each other the rules of classification.

4. From seeing to t*elling* 'rock piles'

In the past, research on laboratory communication theorised the physical setting and particular objects in it (e.g., inscriptions) as ground over and in reference to which talk and gestures are deployed (e.g., Woolgar, 1990). In such work, the importance of perceptual aspects in the alignment of interlocutors was recognised but perceptual

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[2] The following transcription conventions are used: (3.1) — Time in seconds; (.) — micro-pause, less than 0.2 seconds; *Italics* — description of action, gesture; this — underline indicates stressed utterance; why:: — colon to indicate lengthening of phoneme; ^ — moment in the transcript corresponding to the video frame displayed to the right; [— to indicate overlap of different speakers or utterance and action of same speaker.

gestalts were elevated to the same level as signifying practice that are held by utterances and gestures. Such a theoretical move was recently proposed in two independent studies (Roth & Lawless, in press-a; Streeck & Kallmeyer, 2001). In the introductory example, I showed that in some workplace situations, perceptual gestalts are central to understanding and communication but may resist verbal and gestural articulation. In this section I show how in classification work dealing with novel situations, scientists often develop perceptual gestalts prior to articulating them, for example, in operational terms.

For two years, we followed Sam, a doctoral student in her third and fourth year of doing fieldwork (she had spent an additional two years doing fieldwork for her M.Sc.-related work). During these two years, there were frequent instances in which Sam was faced with how to describe the life history of lizards. She needed to find, categorise, and articulate the lizard world. In her work, involving years in the field and associated physical hardship, she developed an understanding for the lifeworld of lizards (Roth and Bowen, 2001a). To write her dissertation and to publish her work in journals, Sam had to find ways to articulate this understanding, which largely existed in the form of perceptual gestalts and 'anecdotal data'. That is, she had to operationalise legitimate points for measuring distance to a bush, forest edge, distance to the forest edge, how to measure (estimate) distance to the forest edge. She also had to operationalise how to distinguish a 'bush' from 'not a bush', a 'forest' from 'brush', or a 'rock pile' from 'not a rock pile'. Here, I analyse the interactional work—involving the fourth-year undergraduate student Belle—that was part of the emergence of the 'rock pile' category.

At the beginning of the day of the episode, the category rock pile did not exist in as far as the research project was concerned. Then, as part of their ongoing activities of 'doing sites', a sense emerged that sites should be classified as being members of the rock pile class or not. However, as a member of the scientific community, Sam is accountable for her measurements and classification. This episode therefore is an example of how a perceptual gestalt is elaborated into an operationalisation and because of the

accountability practices in the sciences. The transcript shows that establishing a category is not a once and for all event, but arises as a matter of beginning with some (vague) criteria and than evolving them such that a consistency in classification is achieved.

The first transcript begins after a 12.7-second pause following Belle's question how to determine the distance to the 'nearest rock' given that there were several rocks in a pile, that is, touching each other. Sam not only provides an account for the long pause but also formulates (provides a gloss) of the entire episode to come, 'coming up with a criterion for what counts as a rock pile'. Although Sam identifies the need to create a criterion, she already appears to have a perceptual categorisation scheme that allows her to distinguish yet-to-be-accounted 'its' into the rock-piles and non-rock-piles.

Fragment 1 Transcript 1: CRE 23/07/97 28:53

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01  S:  I just wonder what would classify- it would be, we
        need to come up with a cri- (0.3) terion for what's
        a rock (.) pile.

02  B:  Yeah

03      [(16.9)
        [((Both stare at a 'pile' of rocks next to them))

04  S:  Is that, so [that wouldn't classify as a rock pile?
                    [((Points to ground, circular gesture
        above rocks))

05  B:  Yeah, and then there is, like if you said it was
        like ten rocks or something within a half-meter
        radius or something.

06      [(9.1)
        [((Both stare at the rocks to be classified))

07      Sorry.

08  S:  Yeah.

09  B:  I am causing you problems?

10  S:  No, it's just, I am just trying to think of how to
        classify (.) and then there is the additional
        problem that I've already

11      (1.4)

12  B:  Counted without [doing it so
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13  S:                    [Measured all of these sites without
        doing it.
14  B:  But it doesn't matter.
15  S:  The intention was that this nearest rock distance
        would esti- (0.2) would be a measure of that (.) but
        I am not sure if it necessarily is (.) because there
        is cases when there is (0.9) zero distance but not a
        rock pile.
16  B:  Yeah.
17      (2.5)
18  S:  Well let's try it. (1.3) Maybe develop something or
        other.
```

In the first instance, Sam points to the ground and asked Belle whether the unspecified 'it' would count as a rock pile. Though Belle's status is not that of an equal, Sam takes her input (she shakes her head) as a valid case of categorisation. Belle then suggested a possible operationalisation. If 'it' has '10 or more rocks within half a meter radius', it *is* a rock pile. Sam doesn't respond but is concerned with the fact that she has already done a number of sites. That is, she has already collected the measures she wanted at a range of sites without having collected the information as to whether a capture site is in a rock pile or not. She raises an additional concern: there are zero distances to the next rock, but the capture site is not a rock pile (for example, when a lizard was caught on top of a rock). But in the end, she decides that they should try collecting an additional measurement on each capture site that involves classifying 'it', and if 'it' is a rock pile, measuring its distance to the capture site.

Here, Sam already has a sense that the yet-to-be-specified 'it' does not classify as a rock pile (line 04). That is, Sam has a sense that the perceptual gestalt does not lend itself to be articulated as 'rock pile' but she does not have a way of *telling* it from its alternative. Which 'its' are rock piles and which 'its' are not is a matter of an emergent scheme of categorisation that draws on the embodied, perceptual sense of the nature of a rock pile. There already exists an initial, perception-based sense for telling which 'its' are

rock piles and which are not. But each instant requires a renewed interaction as to the particulars of the specific classification. That is, by looking at a number of rock piles, their embodied understanding further develops as they attempt to operationalize just what makes an 'it' a (non) member of the group 'rock pile'.

The episode unfolds, attention of the researchers focused on other issues of the data collection. The next excerpt relevant to classifications begins in line 19. Here, Sam questions whether a particular site lies in a rock pile or not. Rather than beginning with the criterion stated earlier by Belle, she draws on her embodied sense to make two contrasting classifications. She points at the 'it' in front of her which is a not member of the class and contrasts this with another 'it' which she does regard as a member. In lines 24–25, the two come to an agreement about the (tentative) classification, which then leads to Sam's suggestion that they try the greater-than-ten criterion (line 24). At this point, she adds a new column to her field notebook.

Fragment 1 Transcript 2

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19  S:  Rock pile or no rock pile? So I would say
20      [this is not a rock pile, but I would say
        [((circling gesture over rocks))
21      [that one is a rock pile.
        [((points into the distance))
22  B:  Which one?
23  S:  [166.
        [((looks and points into the distance))
24  B:  Oh yeah, OK.
25  S:  So let's try the, let's try the greater-than-ten
        one.
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At this moment, Sam and Belle have arrived at a first tentative articulation of the rock pile category (greater than ten). What had existed only as a perceptual distinction now has a verbal equivalent. Whereas Sam's perceptual sense allows her only to distinguish 'rock piles' from 'non rock piles', the 'greater-than-ten one' is acceptable as a formal criterion in the academic community. It is in this community that Sam is accountable for

her local practices to make them amenable for transportation to another site. Their embodied sense of what constitutes a rock pile, while sufficient to classify all of Sam's samples, is clearly held insufficient in the context of their scientific work which is to be made public. In this case, some operational definition that can be communicated to other members of the ecology community needs to be established. However, this does not alleviate the problem for people in some other side who, for themselves, have to re-establish an embodied sense, based on the published criteria, of which 'its' do and which ones do not classify as rock piles. Despite the fact that the perceptual gestalt precedes verbal articulation, there is an asymmetry between the two in the academic community. Different kinds of pedagogies exist at the research site (where perceptual orientation and deixis are sufficient) and in the professional community.

The project of evolving a way of *telling* the different 'its' apart is not yet complete, although they may have a shared sense of the distinction at the perceptual level. The current telling is provisional and may change as they encounter new 'its' in which the verbal articulation conflicts with the perceptual sense. One such event occurs just as the two walk arrive at the next capture site but a few meters away. Belle checks with Sam whether the rock she identified as the capture site is in fact the one that Sam had caught the lizard under. Belle then suggests that the 'nearest rock is zero'. That is, her statement not only describes the distance to the next rock but at the same time does not classify 'it' as a rock pile. However, the episode shows that the issue is more problematic than that.

Fragment 1 Transcript 3

```
26  S:  Well, at the moment, the category stands at is
        greater than
27      (0.9)
28  B:  Ten=
29  S:  Ten rocks touching=
30  B:  =Like greater than ten (0.8) touching the rock?
31  S:  Touching (0.6) each other.
```

32 B: Oh?

33   (1.4)

34   And what about the size of the rocks? Or does that
         not matter?

35 S: I don't think that matters? 'Cause you can have big-
         rock piles and small-rock (.) [piles

36 B: [There is like one two
         three four five six seven eight nine.

37   (1.6)

38 S: You see, if I was, if I was eyeballing it, I
         wouldn't call <u>that</u> a rock pile.

39 B: OK, because there <u>are</u> like 10 rocks in it.

40   (1.2)

41 S: <u>Are</u> there?

42 B: Yeah.

43   (1.2)

44 S: OK, I am going to up that.

45   [(2.8)
         [((Laughs))

46   You don't like your categories, just change them.

47   (1.8)

48   'Cause what I am thinking in my mind is (.) is like
         real, like talus.

49 B: Yeah, [like the [bi::::g piles of [rock
               [[((Spreads arms)) [

50 S: [Is   [The piles. Yeah,
         that is what I would (0.2) Now we could break it
         down into a category. But I am not sure that (0.7) I
         really want to rush around counting rocks. I'd
         rather just say rock pile no rock pile.

51 B: Yeah. (1.1) But it was just a thought.

52   (1.2)

53 S: Yeah, no I think that it's a good it's a good one.

54   [(4.8)
         [((Flips through notebook))

55   OK, let me. OK, so (1.1) rock pile.

In this situation, Sam and Belle reiterate their operational definition, 'At the moment, the category stands it's greater than ten rocks touching one another' (line 26). This statement not only states their definition but also its provisional nature. In lines 28 and 29, Sam and Belle reiterate and thereby confirm their articulation and, simultaneously, signal their mutual agreement. Belle raises an additional point whether they should account for the size of the rocks that make a rock pile (line 33). But Sam suggests that the actual rock size does not matter.

The next few lines (37–41) are critical, for here the previously established operationalisation is being questioned. Belle begins by counting as Sam suggests, based on her 'eye-balling' the 'it' before them is *not* a rock pile (line 37). Belle contrasts this classification with the count, 'there are 10 rocks in it'. Sam is surprised, and then suggests a practical solution to this problem: 'I am going to up that' number which makes a rock pile of an 'it'. Because perceptual gestalts are indexical, a quality that inherently cannot be overcome by uttering so many words. However, Sam provides a gloss of the perceptual activity 'eye-balling' on the grounds of which she argues that the 'it' at hand cannot be called a rock pile (line 37). The nature of this 'it' is not questioned and therefore taken-to-be shared by both.[3] In line 47, Sam provides another gloss of a rock pile, which is 'like talus'. This expression, too, elaborates the perceptual gestalt but without any hope of being able to overcome the indexical properties of perception. Sam did not change her categorisation, which already existed at the perceptual level, but rather the way should would account for the members in the rock pile class when it comes to publishing (thesis, article) for her measures. She then elaborates her embodied sense of what constitutes a rock pile: She has in mind a 'talus' which Belle describes as a 'bi::::g pile of rocks'. One solution to the problem they have at the time is have a multi-category

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[3] My own research shows that even if members of a group are attuned to the same perceptual field (such as a physics demonstration), this does not guarantee that the perceptual gestalts of two or more individuals are the same. In fact, these gestalts may be quite different—some see motion where others do not (e.g., Roth et al., 1997).

scheme that accounts for the different sizes of rock piles, but Sam rejects this option

which would require her to count the rocks in order to enact a multi-classification

scheme.

What we see in this fragment is how verbal articulations come about to gloss and

account for the perceptual gestalts that already distinguish 'rock piles' from 'non rock

pile'. We see how the members of this group come not only to agree on the perceptual

differences between instances and non-instances of rock piles but also to *tell* the

difference between the two pile. Establishing a verbal account of the difference

presupposes knowledge, which participants deliberately consulted, when they needed to

establish a code that encapsulated 'what really matters to the life history of the lizards'. It

is in their joint work of looking at the same piles that they build a practical sense for

doing classification into rock piles, and therefore develop an understanding of the

different circumstances and knowledge of how classification works that they can appeal.

My research shows that these researchers draw on their understandings of how *this* place

works prior to how such places work when they are to account for anomalies in data, or

when they interpret line graphs (Roth and Bowen, 2001b; Roth, Masciotra, and Bowen,

in press). That is, in the interaction, Sam and Belle establish an account for their existing

(embodied) perceptual distinction of what kinds of 'its' can actually rather than

conceivably be a rock pile. We witness the ethnomethods of establishing how that is what

to count as a case and what to count as a non-case. We indeed witness the work which

aligns perceptual gestalts and verbal descriptions; 'categorising as' or 'counting as'

emerge as unavoidably situated practice that establishes 'rock piles' as progressively and

discursively exhibitable rock pile. 'Classifying as' and 'counting as' become, in other

words, performatively objective.

5. Perceptual gestalts 'go without saying'

When the scientists (or others working in this site, like those sorting coho for marking) classify under normal circumstances, the 'work' is unnoticeable. Classification is an ordinary, unremarkable activity. It is so unremarkable that I received 'funny looks' when asking individuals to explain why they classified objects in the way they did. Among the hatchery workers or in the vision laboratory, perceptual gestalts go without saying. At best, they are glossed in ways that still leave to the newcomer the work of learning to *perceptually* distinguish instances from non-instances of a category relevant in the situation. Only when I was able to make those distinctions could I become an insider, knowing what was going on without asking 'stupid' questions about it. I often learned (as in the case of sorting coho, or taking stickleback out from the salmon) by observing and developing a sense for doing the classification myself. For example, sticklebacks look deceivingly similar to salmon (to the novice), being about the same size and have a similar silvery sheen. But close observation of the classification activity allows one to become attuned to particular features, shape of the head, fins, etc.) Initially, I asked one of the fisheries scientists to verify the classification I made until I felt sure that I could do it myself, count and discard the stickleback. In a similar way, I learned to classify coho by size in attempting to 'predict' into which tray the individual would go as the worker grabbed an individual.

Much of the work in a hatchery or in during a sampling episode in an estuary goes without saying but are noted by the participants, who are aware that the others note the same things. It is when they do not go without saying, when there is trouble of some sort, that coparticipants in the situation make the trouble visible to each other as well as their ethnomethods for doing their activities, here classification.

a.   b.   c.
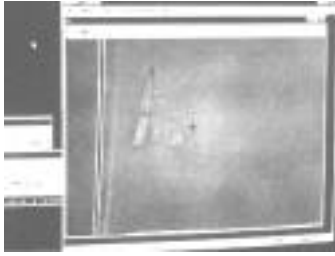
```
(Greg moves on        M: Is this a cone?    G:   Double cone.
without comment)
                      G: Yeah, it could
                         be.
```

Figure 2. a. Moving on without a comment 'tells' that the object is not a cone. b. Learning a perceptual gestalt. c. Telling the object.

In most cases, Greg does not even describe the entities (Figure 2.a). He moves on to search for another one, focuses and moves on unless it is an entity of interest. When the image continues to change, the laboratory members present 'know' that Greg has not only continued to scan but also that he perceived the object as a 'rod'. Continuing on does not only change the perceptual field but also tells others that the entity is not of interest. More so, (initiate) lab members know what is going on and what Greg has perceived, and they know that Greg knows the same about them. In turn, the silence of other members present 'tells' Greg that they are in agreement with his assessment. That is, the absence of utterances and gestures communicates to the members of the laboratory what is going on and what others are attuned to. It is only when someone less familiar with their practices, such as myself, that Greg feels the need to verbally account for the object that he has passed over (Figure 2.c). Now, after having spent more than a year in this laboratory, I am no longer in need of being told—none of the lab members tells the object as they had done in the beginning. If I now asked for a naming or description of the perceptual gestalt available to all, it would be seen as odd behaviour, for I am expected to be able to see and instantly know.

Because I had joined the laboratory just recently, I was not yet able to distinguish between the different perceptual gestalts. I frequently asked a question about the nature of the entity or stated a classification hypothesis (Figure 2.b). It is through the feedback

from the others in the laboratory that I learned, over time, to perceive the field in a way that the appropriate perceptual gestalts were salient. In this present case, the entities are not clear, even to the experienced researcher. Greg moves on and does not take a reading from this object. That is, although it could be a cone, which he was to record on this day, Greg did not appear to make a sufficiently clear perceptual distinction to attempt to pair it with a signal. Sometimes, Greg points to the screen (Figure 2.c), saying 'double cone', 'single cone', 'rod', or 'epithelium'. Most often, the screen display has many shades. What is and what is not an interesting entity is not self-evident.

When there is trouble or when perceptual gestalts are unusual and difficult to discern, laboratory members draw on other communicative resources such as gestures and utterances to instigate others for finding the perceptual gestalt apparent to them. Seeing the display in ways so that the perceptual gestalt actually isolates interesting things only emerges over time. They can often not told (Figure 3.a) or been shown in gesture. Pointing toward the screen and even putting the finger on a particular place does not eliminate the uncertainty:
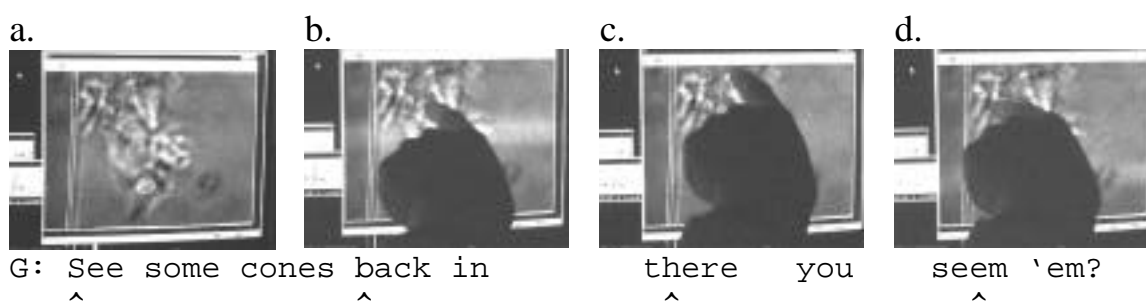

a.   b.   c.   d.

G: See some cones back in   there   you   seem 'em?
   ^   ^   ^   ^

Figure 3. The gesture marks a region within which to find the 'cones'.

In Figure 3, Greg uses gestures in isolating what is to be figure against the rest, which is the ground; in the same way, he outlines double cones with the 'dividing line between them'. Identifying what is figure, that is, identifying the 'object' has to do with finding the boundary that separates one part of the perceptual field from all of the others. The question now is where is this boundary, and how to teach perceiving it when it is difficult

to tell it as an order. To make this boundary salient and thereby to assist others in seeing what he sees, not just words but gestures are used. Together, the three aspects (image, gesture, talk) communicate. But the perceptual gestalt has to be learned although it can not be said and often not be shown. Despite the circling finger, the recipient of the communication still has to perceptually isolate the gestalt in the same way that each observer of the fish sorting women has to find in his/her own perceptual experience the relevance of a fish going to the left or right station or into the bucket for the too-small-to-be marked. That is, the observing member has to identify the particular perceptual gestalt that would make the particular gesture and utterances an appropriate gloss. That is, it is not that the recipient follows Greg's instruction for seeing and thereby finds what the speaker has identified. Rather, the recipient isolates a perceptual gestalt that allows utterance and gesture to be reasonable glosses and deictic references.

Outstanding features that make for 'nice' or 'textbook' examples and 'beauties' facilitate identifying perceptual gestalts and distinguishing them from other such entities. Beauties and textbook examples serve as pedagogical devices that allow insiders to teach others making perceptual differences (Figure 4).

```
G:  Oh, yeah, that's nice, that's a
    beauty- Textbook example.
```


Figure 4. 'Beauties' and 'textbook examples' also contribute to making perceptual distinctions.

Gestures are part of the communication that together with the image and talk constitute what is being available to the co-participants. Gestures often precede what they say or point to the object before the associated indexical or name is uttered. In the following utterance, the gestural index is uttered considerably before 'this guy here' (Figure 5), itself naming and locating the entity that thereby becomes the topic of the talk.
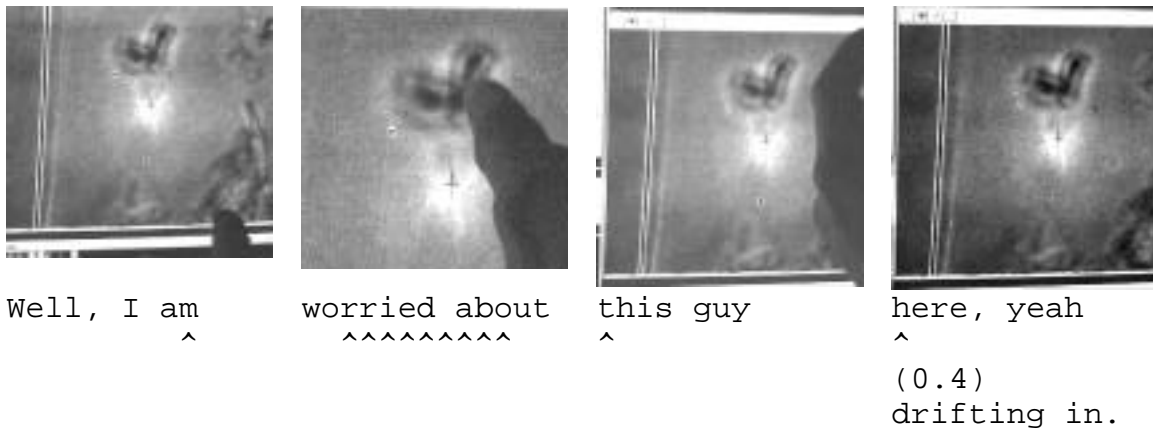
```
Well, I am        worried about    this guy        here, yeah
     ^            ^^^^^^^^^         ^              ^
                                                   (0.4)
                                                   drifting in.
```

Figure 5. Verbal ('this guy') and the gestural deixis are asynchronous. The verb 'drifting' constrains the perceptual gestalts marked as salient by 'this guy'.

Learning to make perceptual distinctions underlying classification is facilitated when the entity stands out with respect to the ground in a particular way. When some parts of the perceptual ground move with respect to an invariant part, identification is facilitated. In Figure 5, the verb 'drifting' in the verbal modality put a constrained on the perceptual gestalt, although the verbal ('this guy') and gestural deixis asynchronously referred to what was to be made salient. The description 'drifting' and the simultaneous perception of movement forced the asynchronous modalities to coincide. The verbal, gestural and perceptual modalities do not have to be entirely synchronous. In such pedagogical situations, the perceptual gestalts actually become topics of the talk (communication). 'This guy drifting in' marks the entity. At the same time, it is the perceptual gestalt that tells the remainder of the story to the recipient. The movement of 'the guy' into the collimator beam, aligned to take a reference (control) measurement, would change the measurement. There is a sign-referent relation between 'guy' and the visible object, though guy does not specify just what object it is. However, this may not be a lacuna at all because the participants can identify the nature of 'the guy' on their own. If 'this guy' is a cone or a rod or some other object whose identity can be taken for granted, this nature goes without saying so that naming it appropriately is not necessary.

6. Perceptual gestalts and turn-taking

In the previous sections, I show that perceptual gestalts are important features of laboratory conversations. In a functioning lab or field-research situation where members are familiar with each other and the work, these perceptual gestalts are, by default, taken-as-shared. They 'afford' certain information to those perceptually attuned and this information is taken-as perceived by the other. That is, perceptual gestalts constitute a sign form that contributes to the continuing updating of the scientists' understanding of the situation. These perceptual gestalts need no further saying; telling (accounting for) a perceptual gestalt marks a particular purpose—assisting a novice in understanding the unfolding situation. If such a purpose is not immediately apparent, members will attempt to find out. Among regulars in the lab, telling an object is an odd thing to do. It remains to be shown that perceptual gestalts are an integral part in turn taking in the way gestures when the verbal channel is unavailable.[4]

Streeck and Kallmeyer (2001) showed that inscriptions produced during the meeting produce perceptual gestalts that are integral parts in conversational turn taking. In this section, I show that perceptual gestalts are integral parts even if they are not tied to inscriptions that are salient because they have been produced as part of the ongoing interaction. Nevertheless, these perceptual gestalts have their origin in the interactions that the members of this laboratory have had over time and, in this, have become 'affordances' to them. Because they are affordances, information relevant to those present, perceptual gestalts shape conversations-in-interaction that make for collective laboratory work. The fragments in this section have been taken from the database in the experimental biology laboratory focusing on fish vision.

---

[4] The driver of one car blows the horn. The driver of another one shows the finger. The first shows a finger in his turn.

Just preceding the following episode, Greg has asked Tony to save the image of the cone that they had taken an absorption spectrum from. Tony moves the cursor to the menu FILE (line 01), and then draws the black highlight bar to a save option (line 02).

Fragment 2 Transcript 1: JUL 21, 2001, 1:05:42 p.m.

```
01  T:  ((Moves cursor to 'FILE' and
        pulls down window))

02      ^
        ((Releases and image flips




03      [^
        [((image stays for 3.9 seconds,
        flips to next image))
        [((cursor moves to bottom
        field, then to 'cancel' and
        clicks it))



04      ((image flips)) ^

05      (0.8)

06  G:  [So an a-v file is all right?

07  T:  [((tracks cursor across screen
        to menu 'file'))


08  T:  [It's a movie file that's why I
        [((clicks 'FILE' menu
        [^

09      didn't look at'it

10  G:  Ah, OK.
```

A new window opens (line 03). Tony moves the cursor into the field with a default file name, clicks in field, then clicks the CANCEL button, whereupon the window disappears (line 04). While Tony continues to track the cursor toward the FILE menu and

after a 0.8-second pause following the change of the image, Greg asks 'So an a-v file is all right?' (line 06). Tony responds that he did not look at 'it' because 'it's a movie file'.

In this episode, Greg was perceptually aligned with the events on the monitor. Thus, Tony did not just pull down the FILE menu, clicked to enter the cursor into the 'file name' field, and then clicked the CANCEL button. Rather, each action also communicated to Greg that something was being done (even if it turns out later that his understanding differed from Tony's). Greg takes his turn in line 06, which follows Tony's action. As the default filename had an extender of '.avi', Greg asks whether it is OK to save it in this format. He did not just perceive Tony do something but also 'was told' that 'it is all right to save the file in avi format'. He responds to Tony as if this one had said, 'I am saving it in avi format'. In his turn, framed in the form of a question, Greg both acknowledges his uncertainty and also asks for elaboration. Tony, however, responds as if he had heard Greg ask him to account for his clicking of CANCEL. Tony in fact provides a gloss of his action rather than answer to Greg's question. He had not continued with saving but clicked the CANCEL button because 'it's a movie file'. AVI is format and a filename extension that PC computers use for movie files.

In this situation, Tony's actions and what the perceptual gestalts that they provided for others in the lab constitute turns. As long as there is no indication of trouble (signalled among others by the bids of others for a turn), Tony continues and the perceptual gestalts change, communicating to others what he does. When one such communicative act is uncertain, Greg takes a turn, followed by an exchange of turns until the troublesome situation was repaired (line 10). One such troublesome situation is evident in the following transcript (fragment 3). Whereas the researchers normally perceive the presence of a perceptual gestalt but do not acknowledge it verbally, the appearance of an unusual 'spectrum' led to a verbal interaction.

Fragment 3: JUL 20, 2000 2:16:05 p.m.

```
01      [^
        [((Image appears))
02      (1.0)
03  T:  Ü::ee::::
04  G:  Üe::
05  T:  hhhhh •hhh hhh what have you
        done [there? hhh •hhff]
06  G:       [Right off the-  ]
07  T:  Right off the scale hhh •hee
08  G:  Let me see if it moved
```



```
09      [(0.8)
        [((turns to microscope
10      Yeah (.) it moved off.
```
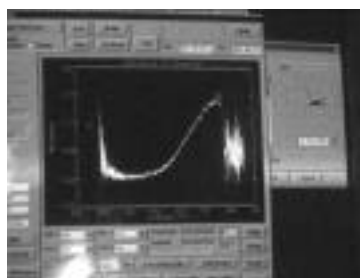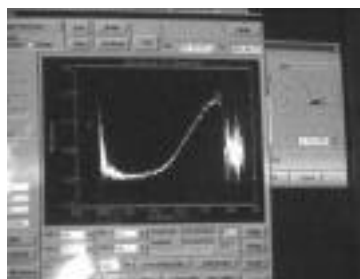
Both Tony and Greg are oriented toward the monitor. They greet the image with onomatopoeia: both know that something has gone awry. In the second part of the episode, Tony requests an account for what had happened. Greg does not respond to the question but describes what he perceives, 'right off the-'. Tony reiterates and thereby confirms the reading—even without Tony's mention that 'right off the-' means 'right off the scale' both know that this was the state of affairs. Even before, the onomatopoeia already are their 'gloss' that the graph was off the scale of what ought to appear. It is not even the graph in itself that they comment upon but the relationship of the graph with respect to the axis scale. Greg then provides an account of the action he is about to take: turn and take a look through the microscope to see whether the object has moved. It is here that he answers Tony's original question, 'What have you done here?' Tony asks a question that does not pertain to the image; rather, he attempts to ask Greg what he had done (with the microscope, lining up the cell). But Greg (line 06) and Tony (line 07) gloss for the perceptual gestalt ('right off the scale') that had led to their initial reaction expressed in onomatopoeic form (lines 03, 04).

When a member is uncertain about whether others are attuned to the same perceptual gestalt, they enter repair sequences. These sequences may consist of simple pointing (gestural deixis), iconic gesturing, utterances or a combination of these. Even during these repair sequences, members expect others to be perceptually attuned and take account of this in their turn taking. This is evident in the following episode (Fragment 4).

Immediately prior to the episode, Greg glossed the perceptual gestalt (under the microscope) with 'single cone'. The graph unfolding on the monitor does not support this perception but rather suggests a double cone, with a red or green absorbing member. The

Fragment 4: JUL 18, 2000 2:57:08

```
01  G:  Well it can be a green ahhh
        double
02      (0.7)
03  T:  On the si[de
04  G:          [flipped over
05  T:  Yeah
06      (1.0)
07  G:  What's lambda max there on
08      [that?
    T:
        [Right away, (0.6) [cursor
                    [((Puts cursor on
        curve, clicks))
09
10      (5.0)
11      ((Clicks in field below graph))
        (2.2)
12      What is this?
13      (2.3)
```
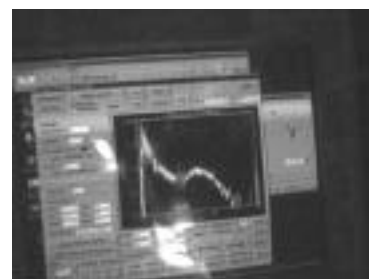
```
14         ^
15         (0.5)
```



```
16         [Can you read this?
           [^
```



```
17  G:   five sixty-three
18  T:   five sixty-three?
19  G:   Or five fifty-three
20       (2.1)
21  T:   Would that be a red already or
         what?
```


In response to Greg's question about lambda max 'there on that', Tony acknowledges the request both verbally ('right away') and by moving the cursor to the peak visible in the centre of the graph. He clicks on the graph (line 08) moves the cursor to one of the fields just below it and clicks (line 10). After a 2.2-second pause, Tony questions 'What is this?' (line 12). Clearly, he expected a turn, which did not come. His immediately preceding actions were those of clicking on the peak of the curve and then clicking in one of the fields below the screen. In this situation, lambda max can be read in two ways. Either one imagines a vertical line from the peak down to the horizontal axis and estimates its value or one reads the numerical value from one of the fields after the crosshair-shaped cursor had been clicked on the spot of interest. Tony later suggests that because of the parallax, it is almost impossible to do reliable readings from where he is sitting and looking at the monitor. These turns follow Greg's question about lambda-max.

Tony's turn can therefore be heard as a request for responding to his own turn in which he produced a response to Greg's question available as perceptual gestalt.

Again, there is no response so that (after a 2.3-second pause) Tony moves his hand forward and touches the monitor near a field just below the graph (line 14). Again, there is no response, and Tony, as his finger continues to move away from the monitor, provides yet another request for doing a reading (line 16). The pause is lengthy in normal conversational terms but does account for the time one might allot if looking for and identifying the perceptual gestalt is taken into account by the requester. They then have an exchange in which Tony ascertains the reading Greg actually has made. That is, Tony's verbal and gestural actions can be heard and seen as requests for a turn that was not forthcoming. 'Can you read this?' (line 16) is both a gloss of the earlier deictic gesture and a reiteration of the request.

The turn-taking sequence in which the perceptual gestalt is involved is structurally similar to the request that completes the sequence. Here, Greg accomplishes his reading but does not comment upon whether how this reading relates to the earlier hypothesis about the perceptual gestalt under the microscope. In line 01, he had revised his description to a green member of double cone. In line 19, Tony asks whether the reading of 553 nanometers is an indication that the curve peaks in the red part of the spectrum and therefore is an indication that the cell under the microscope really is a red member of a double cone.

In the same way, the absence of an utterance is not a lack of communication, the ground against which communication takes place. Rather, communication is understood as a continuous stream of information once the perceptual gestalts have been made an integral part of the analysis. As long as there was no trouble, all lab members simply watch the screen. Each perceptual gestalt is not only evidence of the current status of the ongoing event but also a piece of information taken as shared by the members. Each move Greg makes constitutes therefore also a communicative act and therefore a turn. He
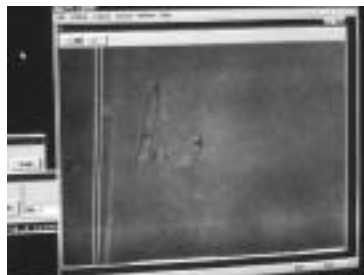
took his turn following an action, which, from his perspective, was also a communicative act.

Fragment 2 Transcript 2: JUL 21, 2001, 1:06:39 p.m.

```
01  G:  [(2.5)
        [((image focuses in and out))
02      [^
        [(1.0)
        [((image stays))
03      ((Image flips

04      [(0.4)
        [((image moves across slide))
05  G:  [Rod
        [^
```
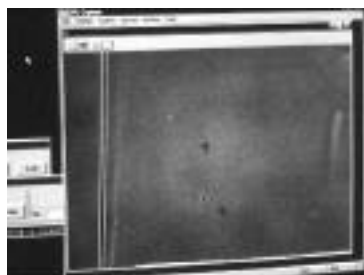

As the researchers watch the monitor that displays the image from the microscope, and entity appears. It is seen as becoming sharp, then fuzzy and then sharp again; the entire process lasts 2.5 seconds from the moment the object first came into the perceptual field. Once the image is sharp, it stays for 1.0 seconds, then the field rapidly changes—as the microscope continues to scan. Following a 0.4-second pause after the disappearance of the object while the field continues to change, Greg utters 'rod'.

Those familiar with the operations know that Greg is searching for retinal cones for measuring their absorption; once found, he needs to set the correct depth of vision and focus the image of the cone. In this situation, the other laboratory members 'see' and understand that Greg has found an object, which he then prepares for inspection (line 01). Resting on the image allows all participants to become perceptually attuned to the entity (line 02). In moving on, Greg 'says' that the image is not of interest; nevertheless, he labels the object as a 'rod' after it has already disappeared. By uttering 'rod', Greg not only names the entity but also accounts for the moving on. It would not have been

intelligible if he had said 'cone'. If the other members had not been in agreement with the assessment embodied in the moving on then they would have made a remark or questioned the move. (Such as my question, 'Is this a cone?' [Figure 2.b].)

Here, the perceptual gestalt is an aspect of the turn-taking pattern. 'Perceptual turns' are different from utterances in that they can take place simultaneously of several members without that it is heard as interfering with the turn of another. Tony and I perceive the rod in the same way Greg does; agreement is signalled by not questioning the fact that Greg was moving on. In situations such as this, where researchers spend 8 to 10 hours in the laboratory together for days and weeks on end, the absence of utterances does not mean that there is no communication. They have become attuned to each other that changes in the perceptual field are part of the communication go without saying. Agreement is available in and as of the silence, and thereby made available to the other.

7. Discussion

In this article, I provide evidence for the central role visual gestalts take in scientific communication. Visual gestalts are not merely ground against which communication takes place and to which interlocutors refer by means of gestural and verbal deixis. Rather, perceptual gestalts constitute a sign form in their own right and have to be modelled parallel to the gestural and verbal modalities that have currency in pragmatic studies of workplace interactions (e.g., Heath and Luff, 2000). Perceptual gestalts embody function as 'affordances', information specific to (groups of) individuals that provides real opportunities for action (Clancey, 1997). Because perceptual gestalts are information, they have to be modelled as an aspect of communication. Members use these gestalts not by passively absorbing them from their environment (Agre, 1997). Rather, gestalts and the customary routines for using them are structured, giving shape to the communicative interactions by which they are brought about. In this way, situated

communication becomes an aspect of a much broader concern for the situated nature of human cognition.

The idea that perceptual gestalts are a central part of (laboratory) communication may appear to some as odd. However, visual artists (e.g., Bob Rauschenberg) and composers (e.g., John Cage), white spaces and silence have long been used and theorised as figurative rather than background elements (Cage, 1990). Thus, the absence of played notes was taken to be the ground against which music becomes the figure. Pauses were heard as the absence of music. It was in the piece 4' 33", in which a piano player enters the stage, sits down for 4' 33", then closes the keyboard cover and leaves that John Cage called attention to the role of the 'pause' as a figurative entity in its own right:

> in the case of 4'33" i actually used the same method of working and i built up the silence of each movement and the three movements add up to 4'33" i built up each movement by means of short silences put together… (Cage, 1990: 20–21)

The (extended) pause is not ground against which notes are played but figure in the same way and of the same order as any other note. In the workplaces that I researched, the absence of words or gestures did not mean an absence of communication. Rather, (familiar) workplaces provide opportunities not only for detecting information but also for monitoring mutual understanding. The absence of words and gestures communicates that things are going smoothly and that others know that this is the case.

7.1. Perceptual gestalts, gestures and utterances in laboratory communication

The scientists, technicians and hatchery workers in my studies routinely make perceptual distinctions without being able to draw on a set of verbal descriptions that would suffice to articulate the gestalts. More so, the evidence in the third set of examples supports the contention that perceptual gestalts are part of the turn-taking patterns in laboratory communication. It is true that there exists a high degree of alignment between the participants in each of these settings. The interaction participants have worked many

years in their respective setting, and worked together for months if not years. The work often proceeds in silence and the members begin to use gestures and utterances to talk about the work only when trouble is evident. Gestural and verbal modalities are then used in conjunction with the perceptual modality to re-establish the alignment—which subsequently continues to be monitored by perceptual means.

This work adds a new perspective on the role of perceptual gestalts in laboratory communication. Among the school children and students that I had researched in earlier work, perceptual gestalts constituted early and often only forms of communication; gestures emerged subsequently as ergotic movements of the hands ('doing') changed over to become symbolic movements (iconic gestures) followed by verbal descriptions (Roth and Lawless, in press-a). In the present study, we notice again the absence of talk. But in all of the situations, members had worked together for considerable amounts of time. Here, then, perceptual gestalts afforded communication and needed to be accompanied by gestural and verbal modalities only when trouble emerged. This work extends the study by Streeck and Kallmeyer (2001), who had shown that the perceptual gestalts associated with inscriptions produced in and as part of the interaction are part of the turn-taking pattern in communication.

When people work collaboratively, they continuously make available to each other the rational, coherent, consistent, or knowledgeable character of their respective verbal and material actions (Garfinkel, 1967). In this, the scientists in my studies are no different although the extent of their collaborations makes it possible to monitor the unfolding events by perceptual means. Physical actions (moving a microscope stage, perceived as changing focus on the monitor; opening, pulling down and closing software windows) not only bring about changes in the environment but also 'tell' the respective other(s) what is going on. In these situations, verbal and gestural means emerge when someone spots trouble. It is therefore not sufficient to model communicative action as involving verbal, gestural and perceptual signs. The ethnographic work on which this paper has

drawn was conducted in knowledge-producing workplaces, including the 'field' in ecological fieldwork, vision laboratory in experimental biology, and a hatchery and river estuary in fisheries biology. There is a continual change in the setting, tools and objects, in pursuit of new ways of understanding nature and methodology. That is, scientific discovery work is continually in a state of change rather than stasis, forcing scientists and scientific staff to learn to cope with and understand new configurations. There are therefore repeated states when trouble is more evident, requiring a lot of talk-in-interaction, until a particular activity has become routine, at which time it largely goes without saying. What needs to be known is available to all in the environment (the monitor, fishpond) available to all and known to be by all participants.

7.2. Multi-modality of communication

Traditionally, language has been treated as the primary modeling system of communication, often considering non-verbal means as secondary, derivative, or partial translations of the primary system. My research shows that in many workplaces, signs from all three modalities have to be accounted for to understand what is going on. I moved to the consideration of the three modalities (verbal, gestural and perceptual) motivated by semiotic treatments of written (Eco, 1984) and verbal communication (Clark, 1996). As a result, the relationship between the different modalities is symmetrical: the perceptual gestalt of a 'double cone', the utterance 'double cone', or the iconic gesture outlining a double cone each may stand for another during communication. Therefore, we can think of workplace communication as running in any one or more of the three modalities. There is the world before interlocutors and collaborators, affording known perceptual gestalts that are salient on their own or are made salient by means of gestures and utterances. What the videotapes reveal is a multi-level communicative process that has to be modeled concurrently at the three levels

Non-verbal signs have to be considered in a theory of communication because of their prevalence in face-to-face conversation (Bavelas and Chovil in press) and particularly in those interactions when the conversational topic is a feature within the setting itself. Certainly, language is the most powerful semiotic device but there are semantic spaces that it does not cover as effectively as other devices as my examples from the hatchery amply illustrate. In other words, the perceptual gestalts intimately tied to basic processes of human interaction and participant frameworks. Leaving out these gestalts would not allow us to make sense of the interactive nature of laboratory work even in the absence of gestures and words. Perceptual gestalts shape the interaction at the same time that they shape the indexical ground (Hanks, 1992).

Both gestural and verbal modalities have a deictic feature that can be used to foreground the perceptual modality within the interaction. Some readers may assume gestures to be somehow unambiguous, and therefore sufficient to ground some utterance. They are indexes or signs that ground utterances, or expressive media. But this is not so. The shape and direction of the pointing is itself ambiguous so that what is being communicated arises from the interplay of percept, utterance, and gesture. Each constraints the flexibility of the other through the co-occurrence of other modalities. From this triangulation of potentially different meanings, a lower number of specific meanings arise.

7.3. Activity theoretical approach to communication

In the present study, communicative actions were distributed across three modalities—being in this no different from other cognitive achievements (e.g., Lave, 1988). Communication, in turn, was deeply embedded in ongoing activity. Situated cognition approaches emphasise the central role of activity to all form cognition. Activity is also central to an integrated theory of language and language acquisition (Ochs, 1988); objects and words have meanings only in the context of the activities in which we

participate (Leont'ev, 1978). This makes it appropriate to explore the utility of already-existing activity theory to linguistic research—in one such attempt, Bakhtin's notions of 'utterance', 'social language', 'speech genre' and 'voice' were integrated into a coherent activity system (R. Engeström, 1995). Here, I propose an encompassing approach in which the three sign forms (Figure 1) become means of production (tools) of communicative action (Figure 6).
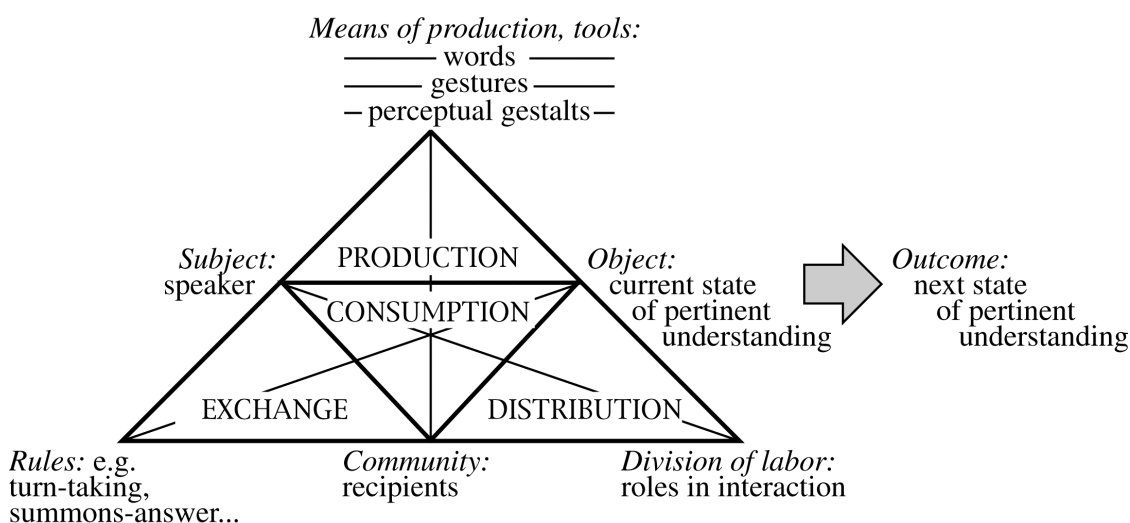

Figure 6. Activity theoretic perspective on communication. Notice, words, gestures, and perceptual gestalts figure among the tools that allow participants to monitor and contribute to the transformation of current states of pertinent understanding to the next state.

Activity theorists analyse situations holistically using *activity* as the unit of analysis. Human activities are generative in the sense that they produce results that are exchanged and thereby become distributed for consumption (Engeström, 1987). In the analysis of specific activity systems, there are six main entities involved in an action: subject, object, tools (means of production), rules, community, and division of labour. However, actions are not analysed in terms of these entities by themselves but as mediated by other entities. Thus, a subject does not just act on an object but tools mediate this action; the community is also mediating the subject-object relation. The relationship between subjects and the means of production are not direct but mediated, among others, by the community.

Most important to the present situation, the *rules* that mediate the deployment of words, gestures and perceptual gestalts are those that conversational analytic studies have shown to regulate communication-in-interaction (e.g., ten Have, 1999). An object is thereby reflexively and momentarily constituted as movement, orientation and talk come to be intertwined with the gesture; together, they provide the resources through which communication takes place. Social action is therefore a process that realises the connection between an individual subject and the objectively available world. The outcome of social action is a continuous transformation of the objective world and our (verbal, gestural and perceptual) images of it. The object is transitional, each new state of it becoming the object for subsequent social actions. The activity theoretic approach articulates communication not only as exchange but also in terms of a distributed event to which several speakers contribute in turn.

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