

Scientists' Orientation to an Experimental Apparatus in Their Interaction in a Chemistry Lab¹

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This study explores the relationship between scientists' orientation to one another and to an experimental apparatus, analyzing as data a videotaped authentic interaction among co-workers in a chemistry laboratory. It demonstrates how the scientists display systematic orientation to the apparatus as their common spatial point of reference on the one hand and as the physical embodiment of the experiment on the other hand.

INTRODUCTION

In this paper I will demonstrate that there is a systematic relationship between how scientists in a chemistry laboratory display orientation to each other and to an experimental apparatus. I will show in what way the scientists' organization of their eye-gaze and body alignment is different from mundane face-to-face interaction in relation to the coparticipants' shifts in spatial positionings vis-à-vis the experimental apparatus within the setting of a science lab while the scientists go through different sequences prior to and during the initiation of an experiment. Whereas other researchers have demonstrated that the interplay between vocal and non-vocal actions is systematic (C. Goodwin, 1981; Schegloff, 1984; Heath, 1986), the relationship between interactants' orientation towards an apparatus and to each other has not yet been investigated.

The interactants' orientation to the apparatus as their common point of spatial reference will be shown within one participant's simultaneous vocal and non-vocal actions, among coparticipants, and across competing interactions. Furthermore, I will argue that the scientists orient to the apparatus not only as a spatial reference point but also as the physical embodiment of the

experiment. When one experimenter challenges the other experimenter's set-up of the apparatus, the latter displays through his vocal avoidance strategy and through his physical turning away from the apparatus that he is orienting to the experimental set-up as the physical instantiation of the experiment.

The analysis of interactional practices, such as the organization of eye-gaze relative to talk-in-interaction, is part of an endeavor of various disciplines engaging in describing and explaining the landscape of human behavior, among them sociology, linguistics, and anthropology. Conversation analysts have discovered systematicity and orderliness with respect to how participants in an interaction utilize conversational practices and how coparticipants make sense of the interaction they are engaged in. Working within the framework of conversation analysis (CA), this study investigates how coparticipants display orientation to one another's vocal and non-vocal action in relation to the sequence in which an action is performed. I will demonstrate, for example, that an interactant's looking at an experimental apparatus is attended to differently by his coparticipant depending on the sequential environment in which it is embedded.

METHODOLOGY

In this section I will provide a brief introduction to conversation analysis. Then, a description of the data will offer ethnographic information about the type of data being analyzed, the locus of data collection, the participants in the interaction, and some technical background pertaining to chemistry-specific references in the data. In addition, this section explains the symbols used for transcription of the data.

Conversation Analysis

Conversation analysis examines how participants in an interaction conduct themselves in an orderly manner. Its focus is on actual occurrences of talk-in-interaction and its "objective is one of describing the procedures by which conversationalists produce their own behavior and understand and deal with the behavior of others" (Heritage & Atkinson, 1984, p. 1). This study analyzes a

videotaped actual occurrence of interaction among scientists in a chemistry laboratory.

Talk-in-interaction displays how coparticipants make sense of their interaction; each turn is not only a realization of an action but also a display of how the interactant interpreted his or her coparticipant's previous turn. Such an analysis is "defensible" in that it "can always be referred to and grounded in the details of actual occurrences of conduct in interaction" (Schegloff, forthcoming).

CA has proven to be an especially powerful approach in our struggle to learn about the relation of talk-in-interaction to other areas of human behavior. Kendon (1990), a psychiatrist working within context analysis, for example, acknowledges C. Goodwin's (1981) CA-based work on eye-gaze as "the single most significant piece of work on gaze in interaction" among "studies that attempt to examine the patterning of gaze direction in relation to other aspects of behavior in interaction, with a view to giving an account of the role it may play in the interactive process" (p. 89). The approach taken in this paper follows work by C. Goodwin (1981), Schegloff (1984), and Heath (1986), in which non-vocal behavior is interpreted in relation to the specific vocal actions during which it occurs.

Ethnographic and Technical Background of Data

The site of data collection was a science laboratory specializing in inorganic chemistry within a department of chemistry at a university in Germany.² The data segment analyzed in this essay represents the first fifty-five seconds of the beginning of an isolation experiment which stretches over a total length of twelve minutes.

There are three participants present in the opening sequence of this interaction.³ The main interactants are two male doctoral students, referred to as Ulf and Jo. Before videorecording, Jo had set up an elaborate apparatus for the experiment. Jo had asked his colleague and fellow-student, Ulf, to assist him since the experiment was rather complicated. This isolation experiment is part of Jo's dissertation, the goal of which is to produce a new chemical combination. Filming started after both chemists had arrived at the site. At the beginning of the experiment, Jo is involved in two brief interactions with Hartmut, a lab technician. I focus on the first data available from the opening sequence,⁴ since interactants' orientation

concurrent non-vocal actions.⁵ The second numbered line (line 93) provides a morpheme-by-morpheme gloss of the German. The bottom line supplies an idiomatic English translation (line 94). In some instances, I did not include overlap marks or other specifics about the speaker's delivery of the turn in the English translation in order to avoid a distortion of the original data, such as when the English word order differs from German. For this reason, the glossed line should always be consulted in reading the transcription.

The letter "J" at the beginning of a line is an abbreviation of the speaker's name Jo. Other speaker codes are "U" for Ulf and "H" for Hartmut.

A pitch peak is noted in the transcript if it is relevant to the analysis. It is represented by the symbol '^' as in

48 H Da^ten (drauf)laufen (gradeaus)=

It should be noted that in CA-style transcription punctuation represents intonation contours and not grammatical units. A period means falling intonation, a comma continuing intonation, and a question mark rising intonation.

Key to grammatical glossing:

- I = informal
- P = marked for plural
- S = marked for singular
- PRT = particle
- A = marked for accusative case
- F = marked for feminine gender
- M = marked for masculine gender
- N = marked for neuter gender

ANALYSIS

The analysis focuses on the relationship between the coparticipants' orientation to each other vis-à-vis the apparatus set up for conducting the chemical experiment. I will demonstrate that this relationship is systematic while the interaction unfolds sequentially. Specifically, the analysis shows how the interactants display continuous orientation to the scientific apparatus as their common point of spatial reference and as the physical embodiment

of the experiment. We will look at three sequences: (1) after the scientists have arrived at the locus of the experiment and prior to the first procedural step of the actual experiment, one interactant achieves simultaneous orientation to the apparatus, the coexperimenter, and the technician; (2) in the ensuing sequence, while one scientist is involved in two concurrent interactions, he displays avoidance of the apparatus and of his coexperimenter; (3) finally, in negotiating the set-up of the apparatus, one scientist's eye-gaze directed to his co-worker and his co-worker's reaction to it display that eye-gaze direction towards a coparticipant in side-by-side position takes on a different meaning than in mundane face-to-face interaction.

Body Torque: Splitting of Side-by-Side and Face-to-Face Position

The chemistry lab is organized in such a way that the experimental apparatus can only be approached from the front. The back side is adjacent to the wall; the left and right sides are closed in by the frame of the flue. An experimenter working with it would have to face the apparatus and at the same time turn his or her back to the rest of the room. If two persons participate in an experiment, the spatial set-up provides for an arrangement in which the participants face the apparatus, standing side-by-side in relation to each other. Indeed, the two experimenters in the data analyzed assume a side-by-side figuration to each other in relation to the experimental apparatus in front of them. Such a figuration, as illustrated in Figure 1, I will argue, is their basic position in this experiment:



Figure 1: Side-by-Side Position

This "parallel" or "side-by-side" configuration is one of two basic patterns of interactants' bodily orientation which Schefflen (1964) proposes for dyadic groups. In a side-by-side arrangement, coparticipants display mutual orientation to a third party or to an object, whereas in a "vis-à-vis" or face-to-face arrangement, coparticipants relate to each other. In the following, I will analyze an instance of body torque in which the experimental apparatus serves as a central point of spatial reference for an interactant as he coordinates his body posture in an intricate combination of simultaneous side-by-side and vis-à-vis position in order to display participation in two competing interactions.

At the beginning of the data segment, the video shows Jo and Ulf standing in side-by-side position in close proximity to the apparatus while facing it. Ulf is standing on the left side in front of the experimental set-up with his lower and upper body as well as his face in front of the apparatus. His body posture and eye-gaze are aligned with the apparatus similar to the way in which a person in an ordinary conversational situation would be aligned with a

coparticipant. Ulf's hands, although within reach of the apparatus, are hanging alongside his body. Jo's lower body is aligned with the flue on Ulf's right side. Jo's upper body is twisted leftwards, his eye-gaze almost 180° away from the apparatus. This body torque (Figure 2) indicates that he must have turned, and in turning, he must have passed facing Ulf and continued twisting further.



Figure 2: Body Torque Position

In this turned posture, Jo is talking to Hartmut, who is on the other side of the room. Their interaction proceeds as follows (data segment #1):

#1

looks at Hartmut away from apparatus

1 J	ihr	machdoch	auch schon	sicherlich		
2	you (IP)	make (PRT)	also already	certainly		
3	you guys	also soon	certainly			

looks at Hartmut away from apparatus

4	gleich	[(ne)	
5	s n	[(a)	
6		[((noise))		
7	make	[(a)	

noise

		— —	
8	(.)		

9 Ulf moves backwards one step

10 H	°()°

Jo's body posture displays his involvement in two concurrent and competing interactions. He simultaneously embodies both of Schefflen's basic patterns of involvement; his lower body's side-by-side alignment indicates orientation to his co-experimenter, Ulf, and to the apparatus, displaying that Jo is basically "rooted" in the experimental action. By twisting his body at his waist-line, his upper body and eye-gaze assume a face-to-face alignment with Hartmut, indicating that he is temporarily involved in another interaction with Hartmut.

Schefflen (1964) describes the phenomenon of "split" body attention as a mechanism by which in a group "a person may maintain postural congruence with one person in his upper body, and with another in his lower body" (p. 328). The instance of Jo displaying a split body posture, however, is much more intricate. His lower body exhibits orientation to the experimental apparatus and his coexperimenter, Ulf, while his upper body is engaging in a separate, yet concurrent, face-to-face interaction with Hartmut. This single, complex body pose not only reflects the interactant's relationship between orientations towards the apparatus and to his coparticipants but also to the kind of involvement: Jo's side-by-side position with Ulf displays his orientation to Ulf as coexperimenter in relation to their physical directedness to the apparatus; his vis-à-vis configuration exhibits a mere conversational interaction with Hartmut.

In addition, apart from Jo, Ulf also displays participation in the creation of this configuration; in maintaining his side-by-side position, Ulf expresses non-involvement in the Jo/Hartmut interaction. Furthermore, he participates in keeping up the configuration basic for the experiment. Ulf's behavior can be interpreted as a waiting posture for two reasons. His arms and hands, which hang alongside his body, have assumed a position of non-speakership. Elsewhere (e.g., Schegloff, 1984) it has been established that hand movements are mostly a speaker's actions. By keeping his hands in non-active position, he displays that he is not a possible next speaker in the ongoing interaction.⁶ Jo, by maintaining his lower body in side-by-side position, displays that he is putting Ulf and the proceedings of the experiment temporarily on hold while continuously maintaining orientation to the experiment.

As noted, Jo's body torque indicates his involvement in two competing interactions. During the closing turn of his interaction with Hartmut (#2, lines 11-13), Jo twists his body back toward the apparatus, halting at a point at which he faces the apparatus:

#2

11 (.)

*Jo closes eyes, turns head towards
apparatus with eyes closed,
opens eyes when towards apparatus
while Ulf steps towards apparatus*

12 J na:ja:.
13 o:h we:ll.

Through this movement, Jo displays that he is phasing out of his interaction with Hartmut. Now that both Jo and Ulf are facing the apparatus, and, in terms of their interaction, are aligned side-by-side, the initiation of the experiment becomes relevant.

Thus, the relationship between vocal and non-vocal actions in these specific data is meaningful only if interpreted in reference to the presence of the apparatus. The scientific apparatus set up for the experiment is used by Jo and Ulf as the common point of spatial reference for their alignment. Whereas in the analysis of this instance of body torque we examined the participants' orientation to each other and to the apparatus, in the next instance of body torque,

during the initiation phase of the experiment, we will investigate the interactional achievement of this position and the role of the apparatus.

Body Torque as a Display of Avoidance of Coexperimenter and Apparatus

The following analysis of a complete sequence of phasing in and out of body torque will lead to the conclusion that this split position can be interpreted as an avoidance strategy within the sequence in which it is embedded. I will argue that within this avoidance strategy the interactant combines avoidance of his coparticipant and of the apparatus.

The segment of interaction to be analyzed occurs after Jo has phased out of the first body torque just discussed. Lines 12-13 (repeated in #3) indicate closure on the vocal and non-vocal plane:

#3

*Jo closes eyes, turns head towards
apparatus with eyes closed,
opens eyes when towards apparatus
while Ulf steps towards apparatus*

 |___|
 | |

12 J na:ja:
13 o:h we:ll.

*Jo and Ulf look at common focal point
of apparatus*

 |___|
 | |

14 (1.2)

15 U .hhhhh (0.8) wieso hasse jetz eigentlich
16 .hhhhh (0.8) why have you (IS) now anyway
17 .hhhhh (0.8) why did you take

*Ulf steps back;
noise of glass clinging*

18	ne	<u>Umkehr</u> fritte.	genomm?	
19	a (AF)	<u>conversion</u> frit.	taken?	
20	a	<u>conversion</u> frit.	anyway?	

Both participants have aligned their posture and eye-gaze towards the apparatus. This common coordinated alignment and Ulf's presence being warranted only by Jo's prior request for his assistance make the initiation of the experiment the next relevant action. After 1.2 seconds (line 14), while both coparticipants look at the apparatus, Ulf poses a question: "wieso hasse jetzt eintlich ne Umkehrfritte. genomm?" ('why did you take a conversion. frit anyway?' [lines 15-20]). In this sequential environment, Ulf's question constitutes a complaint in that he is asking Jo to justify why he chose to install this specific instrument in the apparatus. His question challenges Jo's expertise because it implies that he erred in setting up the apparatus. The falling-rising intonation in "Umkehrfritte. genomm?" (represented by a period and a question mark) adds to this question's function as a challenge (M.H. Goodwin, 1983). Strictly speaking, it is not the prior speaker's utterance which is challenged here but rather an element in the apparatus for whose set-up Jo is responsible. The interactants' relation to the apparatus has opened a new dimension in that, with this question, Ulf makes an instrument in the apparatus the topic of the talk.

By challenging the experimental set-up, Ulf's question also delays the onset of the actual experiment. For 1.5 seconds (#4, line 21), Jo delays the answer:

#4

*Jo and Ulf
look at apparatus*

		_ _ _		
21		(1.5)		

The video data show that Jo's eye-gaze during this delay is directed to the apparatus. Shortly before Jo takes the turn, Hartmut can be heard talking from the other side of the room. His turn is delivered

more softly than Jo's overlapping talk, making most of its content indiscernible to the transcriber. Since Hartmut is not within the video camera's angle, we do not know to whom he is talking. Yet, we will see later (in the discussion of data segment #8) that Jo orients to Hartmut. Jo's talk overlaps with Hartmut's during most of Hartmut's utterance, as we see in segment #5:

#5

22	H	°([anfangn)°]
23		°(begin)°]
24	J		
		wie wollst <u>du</u>	das'n ma.]chn:?
25		how wanted <u>you</u> (IS)	that (PRT) d]o:?
26		how did <u>you</u> wanna	do it then?

In reference to Ulf's challenge, Jo's response avoids giving a justification. By answering a question with another question, Jo shifts the task of providing the answer back to the original questioner. Furthermore, Jo's question is delivered with the same rising-falling intonation as Ulf's prior challenge. In this way, Jo not only returns the question but also the challenge. Jo's emphasis on "du" ('you'-informal singular, line 24) in addressing Ulf establishes a contrast between himself and his coparticipant as well as a contrast between their ways of setting up the experimental apparatus. A little later on in the interaction, when Jo and Ulf are moving towards agreement, Jo stresses their communality by changing person reference to 'we' ("wer" line 71, "wir" line 76).

After Jo's question in overlap with Hartmut's turn (lines 22-26, #5), Jo defers his negotiation with Ulf by turning around to Hartmut, initiating the repair seen in segment #6:

#6

27		(0.2)
		<i>turns around</i>
		<i>to Hartmut</i>
		_
		_
28	J	BITTE?
29		PARDON?

This turn-at-talk, in combination with the speaker's body movement, is designed to display disaffiliation with Ulf and the apparatus. Jo's question "BITTE?" ('PARDON?' [line 28-29]), delivered much more loudly than the previous talk, is specifically designed to be addressed to Hartmut. Amplitude shift is a mechanism by which a speaker can mark his or her talk as disaffiliated with prior talk (Goldberg, 1978). By increasing his volume, Jo thus disaffiliates his current action with his prior action.

This disaffiliation is also displayed in his body movements. In the middle of the one-word other-initiated repair ("BITTE?") Jo turns around to Hartmut, thus indicating to both Ulf and Hartmut that he is phasing into an interaction with Hartmut. Given the circumstance that Jo's interaction with Ulf is in its beginning sequence and Jo's previous interaction with Hartmut was closed, Jo might prefer dealing with Hartmut first in order to clear the way for the new interaction with Ulf.

For Jo, his choice to put his interaction with Ulf on hold, by engaging in an interaction with Hartmut, may be an avoidance strategy. This interpretation is strengthened by an observation concerning his eye-gaze. While turning around to Hartmut, Jo's twisting takes his upper body and head on a trajectory away from the apparatus, first facing Ulf, then facing Hartmut. At the point at which he almost faces Ulf, he slightly lowers his eye-gaze, moving it up again after it has passed Ulf's eye-gaze periphery. Taking the immediate sequential environment into account, Jo's eye-gaze movement displays avoidance of meeting Ulf's eye-gaze. In terms of Scheflen's (1964) patterns of configurations, Jo's upper body moves out of a side-by-side position by turning away from the apparatus. In doing so, he moves through a vis-à-vis pose with Ulf during which he avoids interaction with Ulf by avoiding meeting his gaze.

Given the sequential relevance of initiating the experiment, Jo's continuing involvement with Hartmut can be seen as a further delay. His unmitigated willingness to attend to Hartmut's demands, such as first to respond to the previous turn and then to expand a minimal answer (#7, lines 36-41) displays that he leaves the other demand unattended:

#7

30	H	°willst du	denn	jetz	heut	schon
31		°want	you(IS)	(PRT)	now	today
32		°so	you	want	to	start
					already	

Jo produces two
horizontal head shakes

- |
 | |
 | |
- 33 anfa[ngn]?°
 34 sta[rt]?°
 35 today?°
 |
 36 J [nnee.
 37 [nnoo.
- 38 (0.2)
- 39 J °heut no ni:ch.°
 40 °today still not.°
 41 °not yet today.°

In segment #8, Hartmut proceeds by giving an explanation for his question (lines 42-50), which Jo receives with a 'no-problem' response (lines 51-53):

#8

- 42 H dann (.) (ichlaßich) nämlich dann den
 43 then (.) (I leave I) (PRT) then the(AM)
 44 then (.) (I gonna leave I) the one
- 45 ein'n Töminel nämlich blockiert daß man
 46 one(MA) terminal (PRT) blocked that one
 47 terminal blocked then so that one

Ulf steps toward apparatus

- _____|_____
- | |
- 48 H Da^ten (drauf)laufen (gradeaus)=
 49 da^ta (on it) run (straight)=
 50 runs da^ta (on it) (straight)=

two vertical head shakes

- . _____|_____
- | |
- 51 J =a:lles klar.
 52 =e:verything clear.
 53 =all right.

Ulf's non-vocal behavior displays that he is tracking the interaction as an overhearer. Ulf had stepped backwards, away from the flue (#3, lines 18-20) during the turn just before Hartmut's second involvement. Ulf remains in this position until a pitch peak (indicated by '^') on "Da^ten" (#8, line 48) is audible in Hartmut's utterance. This pitch peak occurs at a point in the turn at which the utterance projectably nears completion, i.e., the sentence has been developed far enough for the coparticipant to project the remainder. Right after Hartmut's pitch peak, Ulf initiates a noticeable shift from a standing posture to a movement, as shown again in segment #9:

#9

Ulf steps toward apparatus

	----- -----		
48 H	Da^ten	(drauf)laufen	(gradeaus)=
49	da^ta	(on it) run	(straight)=
50	runs da^ta	(on it) (straight)=	

Ulf moves forward toward the flue, thus displaying that his interaction with Jo is becoming relevant. His spatial reference point is the flue, the physical representation of the experiment. This analysis shows that there is an interplay between the sequential evolution of the Jo-Hartmut interaction and the non-vocal action of the overhearer Ulf. In phasing back to his interaction with Ulf, Jo's torso goes through the same motions as in his previous phasing into the interaction with Ulf (#3, lines 12-13). Again, his vis-à-vis alignment with the flue and side-by-side position with Ulf as the basic points of spatial reference are evidenced in his phasing in and out of the interaction with Hartmut, seen here in segment #10:

#10

two vertical head shakes

51 J	=a:lles	klar.
52	=e:verything	clear.
53	=all right.	

*Jo produces two vertical head shakes,
turns back to apparatus with eyes closed;
he opens eyes when at previous focal
point in apparatus; Ulf and Jo look at
common focal point in apparatus*

—|—
|—|
(3.0)

54

Just as in phasing out of the side-by-side position, Jo has to pass a face-to-face constellation with Ulf in phasing back into it. Jo again avoids a complete vis-à-vis stance by closing his eyes while moving back. In light of Ulf's prior challenge, Jo's action of avoiding eye-gaze in face-to-face position indicates an avoidance of negotiating. In assuming a side-by-side position which displays orientation to the apparatus, Jo indicates a preference to attending to the initiation of the experiment rather than to negotiating the choice of instrument in the set-up. Jo thus systematically orients to the apparatus as the physical instantiation of the experiment and by doing so, to his coparticipant, Ulf, as his coexperimenter.

Display of Avoiding Coparticipant and Apparatus in Side-by-Side Interaction

After Jo closes his interaction with Hartmut (#10, lines 51-53), the interaction he previously put on hold becomes relevant again. We remember that Jo's interaction with Ulf was discontinued when Jo had opposed Ulf's challenge with a counter-challenge question. An answer to Jo's question (lines 24-26, as shown again in segment #11) is still pending:

#11

22 H °([anfangn)°)
23 °(| begin)°)
 |
24 J |wie wollsdu das'n ma.]chn:?
25 |how wanted you (IS) that (PRT) d]o:?
26 [how did you wanna do it then?

In the turn after Jo's closure with Hartmut, Ulf does not respond to Jo's prior question or counter challenge; rather, he poses a question

himself (#12, lines 55-60), topicalizing a chemical substance in the experimental apparatus:

#12

two vertical head shakes

$$\begin{array}{c} \text{-----} | \text{-----} \\ | \qquad \qquad | \\ \text{51 J} \quad =a:lles \quad \quad \quad \text{klar.} \\ \text{52} \quad \quad =e:verything \text{ clear.} \\ \text{53} \quad \quad =all \text{ right.} \end{array}$$

Jo produces two vertical head shakes, turns back to apparatus with eyes closed; he opens eyes when at previous focal point in apparatus; Ulf and Jo look at common focal point in apparatus

$$\begin{array}{c} \text{---} | \text{---} \\ | \text{---} | \\ \text{54} \quad (3.0) \end{array}$$

banging noise

$$\begin{array}{c} \text{---} | \text{---} \\ | \text{---} | \end{array}$$

55 U ja: ds is doch jetz, M'ment was war
 56 ye:s that is (PRT) now, m'ment what was
 57 ye:s that must be now, one moment what was

58 das jetzt, dee emm eff ne?
 59 that now, dee emm eff right?
 60 that now, dee emm eff right?

The structure of Ulf's turn (#12, lines 55-60) contains several features that C. Goodwin (1987) found speakers produce in word searches built to achieve a shift in activity. According to C. Goodwin's research, the speaker makes the word search itself an activity by displaying forgetfulness or uncertainty. Ulf searches for the name of a chemical substance in the apparatus; he supplies a candidate identification himself and closes with a tag question and rising intonation. His question presupposes that Jo possesses the ability to answer it. Ulf places strong constraints on Jo to participate in identifying the substance in the apparatus and is thereby deferring the initiation of the experiment.

In addition to his vocal action, Ulf turns his head so that he is facing Jo. In terms of Scheflen's (1964) patterns of

configurations, Ulf is assuming a split position; with his lower body in side-to-side position, Ulf shows that he orients to the apparatus and is rooted in the activity of conducting the experiment. His simultaneous face-to-face position with Jo displays his orientation to the activity of negotiating the experiment with Jo.

Whereas in face-to-face interaction eye-gaze directed to the speaker indicates hearership and involvement in the business at hand (Goodwin & Goodwin, 1986), in this institutional setting eye-gaze directed to a speaker has to be understood as a more complex activity. In side-by-side position, while the scientists talk, their unmarked eye-gaze direction is towards the apparatus; and hearership does not have to be displayed by eye-gaze direction to the speaker. Thus, when in side-by-side position a scientist directs his eye-gaze away from the apparatus towards his co-worker, he shifts orientation away from the experimental procedure to the ongoing interaction between the co-workers.

Heath's (1986) in-depth investigation of eye-gaze indicates that looking at a coparticipant "plays a significant part in the process of establishing a common focus of activity and involvement, not simply as a means of monitoring each other's concerns and behavior, but actually in initiating action and activity" (p. 25). By looking at Jo, Ulf places a constraint on Jo to share his focus. Furthermore, by directing his eye-gaze away from the apparatus towards Jo, Ulf displays in a marked way to Jo that he is listening to him and expecting an answer from him. For 3.0 seconds (#13, line 61), Jo does not respond vocally to Ulf's question, yet his body movement is meaningful and informative as a reaction to Ulf's prior eye-gaze:

#13

Ulf looks at Jo

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  _|_
  | |
  (3.0)

```

61

*Jo turns head away from apparatus below
Ulf's eye level and back to apparatus*

```

  _|_
  | |

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62 J Methanol dee emm eff eins, (.)

63 methanol dee emm eff one, (.)

Jo reacts in a dispreferred manner to Ulf's prior non-vocal and vocal actions. Non-vocally, he declines Ulf's pressure to attend to the apparatus or to Ulf, by turning away from the apparatus below Ulf's eye level; vocally he produces an embedded correction (Jefferson, 1983) in responding to Ulf's question. While answering, Jo turns his head down and leftwards, on the same trajectory he used when phasing into his interaction with Hartmut. As Ulf is positioned on Jo's left, a left head turn by Jo would result in his eye-gaze meeting Ulf's eye-gaze. While turning, Jo lowers his trajectory so as to avoid meeting Ulf's gaze. In turning away from the apparatus and in "quoting" his earlier eye-movement when phasing into talk with Hartmut, Jo's body initiates avoidance of participating in the activity Ulf proposed. Towards the end of his turn, Jo's head moves back to a position facing the apparatus, thus indicating that his focus of attention is the experiment.

After Ulf has gained confirmation about the identity of the chemical substance (#13, lines 62-63), he launches a second challenge by offering a counter-suggestion for how to conduct the experiment (#14, lines 64-69):

#14

*Ulf and Jo look at the apparatus
as their common focal point*

	-----	-----
64	U das könnte man doch auch ganz norma:l	
65	that could one (PTR) also quite no:rmally	
66	one could also suck it out quite no:rmally	

*Ulf looks Ulf points with his right
at Jo hand to the apparatus*

	-----		-----	
67	so::, (.) unter, (.) Schutzgas		absaugen.	
68	su::ch, (.) under, (.) protection gas		suck out.	
69	like, (.) under, (.) protection gas.			

This second challenge takes a stronger stand against Jo's set-up of the apparatus in that Ulf proposes a concrete suggestion for improvement. By saying "ganz normal" ('quite normally') Ulf implies that Jo's set up of the experiment is abnormal. By making a suggestion, he offers a better procedure at the same time as he

72 ((irritated tone of voice))
 73 tch! yea:h now have we it(NA) for once he:re.
 74 tch! yea:h now we have it he:re for once.

Jo's irritated tone of voice (#15, lines 71-74), combined with three slight horizontal head shakes, makes explicit that he objects to Ulf's suggestion. Vocally, Jo does not state any technical reason but rather gives a weak argument that since the apparatus is already set up, he does not want to change it at this point.

On Ulf's part, there is no uptake of Jo's justification. After a 1.0 interturn gap (#16, line 75), Jo takes the floor again and offers a stronger reason why he does not want to make changes in the experimental set-up (#16, lines 76-81):

#16

75 (1.0)

works on glass flask in his hands

|_ |

76 J 's: 'o' kein Problem=machn wir diese
 77 it (PRT) no problem=make we this one
 78 but it's no problem=we close this one

Jo looks at apparatus

|_ |

79 J hier zu, (5.0)
 80 here close, (5.0)
 81 here, (5.0)

Jo's turn has two units. The first unit " 's: 'o' kein Problem" ('but it's not problem') acknowledges that Ulf has a problem with the experimental set-up, yet it rejects the seriousness of the problem. Jo's retaliation is expressed by the particle "o," an abbreviated version of "doch" (represented in the translation by 'but'). The second unit, "machen wir diese hier zu" ('we close this one here'), is designed to remedy Ulf's problem by suggesting a slight change in the experimental set-up. Jo's vocal flow ceases with continuous intonation and is followed by a long intra-turn gap of 5 seconds (#16, lines 79-81). During this stretch of silence Jo shifts his eye-gaze direction away from the glass flask in his hands towards the

apparatus. His eye-gaze direction complements his ensuing vocal action (#17, lines 82-87), giving in to negotiating the apparatus. Although he does not go along with Ulf's suggestion, Jo takes the first step towards a compromise by admitting a weakness in the set-up:

#17

82 J tz! (0.5) die Scheise is natürlich
 83 tch! (0.5) the shit is of course
 84 tch! (0.5) the shitty thing of course

 85 immer, (1.0)
 86 always, (1.0)
 87 is always, (1.0)

Jo does not complete his sentence but instead halts in the middle of the turn; the non-completion of his turn is signalled by continuing intonation. Ulf completes Jo's turn (#18, lines 88-90) by suggesting that it will be a problem to remove something from the apparatus afterwards:

#18

88 U dasda hinterher widdarauszuholn.
 89 thatA there afterwards again fetch out.
 90 to get this out again afterwards.

Ulf's turn is the first display of agreement with Jo in this interaction. This agreement, however, is an alignment with Jo's admitting of a weakness which aligned Jo with Ulf. By aligning with Jo's self-criticism, however, Ulf once more displays that he disparages Jo's experimental set-up. After a 2-second gap (#19, line 91), Jo vehemently rejects Ulf's completion and pushes for the initiation of the actual experiment (#19, lines 92-97):

#19

91 (2.0)

*Jo looks towards apparatus*92 J na:::in das nich= .hhh tz! .hh pasa:u:w93 no::: that not= .hhh tch! .hh wa:tch94 no::: not that= .hhh tch! .hh wa:tch*leans towards apparatus,
works on equipment*

95 J laßuns das ma machn=

96 let us that (PRT) do=

97 let's do it=

After rejecting Ulf's completion ("na:::in das nich" ['no::: not that']) Jo calls for Ulf's attention (".hhh tz! .hh pasa:u:w" ['.hhh tch! .hh wa:tch']). He then proposes beginning the experiment by saying "laßuns das ma machn=" ('let's do it='). By using "uns" ('us') he includes Ulf's cooperation. In the next turn (segment #20), Ulf gives in by agreeing to Jo's appeal:

#20

98 U =machnwers so: °o°°kee.°°
 99 =do we it like tha:t °o°°kay.°°
 100 =let's do it like tha:t °o°°kay.°°

Ulf's agreement to go along with Jo's proposal clears the way for the initiation of the experiment proper.

The analysis demonstrates that while negotiating the experimental apparatus, the scientist who challenges his co-worker's experimental set-up achieves a shift in the meaning of gazing at the apparatus. Whereas before it meant orientation to the experiment, in its new sequential environment it means negotiating the apparatus. In comparing eye-gaze organization in mundane face-to-face interaction to interaction in side-by-side position, eye-gaze directed to a speaker has a different meaning. In mundane face-to-face interaction, it displays hearership, whereas in side-by-side interaction, in which hearership is not displayed through gazing at speaker, it marks a shift in the orientation of the ongoing activity.

CONCLUSIONS

This micro-analysis replicates prior work which has found a systematic interplay between vocal and non-vocal actions. Although the analysis of this rather brief stretch of data does not warrant a broader generalization, it has nonetheless expanded our understanding of vocal and non-vocal actions in that it shows a systematic relationship between the way scientists orient to each other and to an experimental apparatus. The presence of the apparatus becomes observably relevant in the interactants' physical alignment to one another and to the apparatus as a central point of spatial reference. In addition, the scientists orient to the experimental apparatus as the physical embodiment of the experiment.

In the social sciences in general, and in applied linguistics in particular, we have striven to select and refine our research methodology; this study demonstrates that conversation analysis is a powerful approach which helps us in our struggle for a clear and defensible understanding of the activities in which human interactants are involved.

NOTES

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² The data were collected and kindly made available by Klaus Munsberg (Department of Linguistics and Literary Criticism, University of Bielefeld, Germany) who also provided a basic audio transcription reconciled by a scientist from the chemistry lab in which the data were collected. I retranscribed a selected data segment according to Jefferson (1984) and included a description of non-vocal actions, a morpheme-by-morpheme gloss, and a translation from German into English.

³ Please refer to Appendix A for a complete transcript of the interaction.

⁴ Strictly speaking, the data do not represent the entire opening sequence since videotaping started after the arrival of the scientists.

⁵ The verbal description and pictorial representation of body movements remain insufficient and unsatisfactory, yet as long as no better technical means to represent them are accessible, we have to resort to this frustrating compromise.

⁶ See Schegloff (1984) for a deeper analysis of these gestures.

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Jo and Ulf look at common focal point
of apparatus

- _ | _
| | |
- 14 (1.2)
- 15 U .hhhhh (0.8) wieso hasse jetz eintlich
- 16 .hhhhh (0.8) why have you (IS) now anyway
- 17 .hhhhh (0.8) why did you take

Ulf steps back;
noise of glass clinging

- |-----|-----|
- 18 ne Umkehrfritte. gen~~omm~~?
19 a(AF) conversion frit. taken?
20 a conversion frit. anyway?


Jo and Ulf
look at apparatus

- _ | _
| | |
- 21 (1.5)
- 22 H °([anfangn)°]
- 23 °(| begin)°]
- | |
- 24 J |wie wollstdu das'n ma.]chn:?
- 25 |how wanted you(IS) that(PRT) d]o:?
- 26 [how did you wanna do it then?
- 27 (0.2)

turns around
to Hartmut

- _ | _
| | |
- 28 J BITTE?
- 29 PARDON?
- 30 H °willst du denn jetz heut schon
- 31 °want you(IS) (PRT) now today already
- 32 °so you want to start already

*Jo produces two
horizontal head shakes*



 33 anfa[ngn]?°
 34 sta[rt]?°
 35 today?°
 |
 36 J [nnee.
 37 [nnoo.

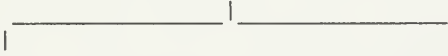
38 (0.2)

39 J °heut no ni:ch.°
 40 °today still not.°
 41 °not yet today.°


42 H dann (.) (ichlaßich) nämlich dann den
 43 then (.) (I leave I) (PRT) then the(AM)
 44 then (.) (I gonna leave I) the one

45 ein'n Töminel nämlich blockiert daß man
 46 one(MA) terminal (PRT) blocked that one
 47 terminal blocked then so that one

Ulf steps toward apparatus




 48 H Da^ten (drauf)laufen (gradeaus)=
 49 da^ta (on it) run (straight)=
 50 runs da^ta (on it) (straight)=
 two vertical head shakes



 51 J =a:lles klar.
 52 =e:verything clear.
 53 =all right.

*Jo produces two vertical head shakes,
turns back to apparatus with eyes closed;
he opens eyes when at previous focal
point in apparatus; Ulf and Jo look at
common focal point in apparatus*



 54 (3.0)

banging noise

- 55 U ja: ds is doch jetz, M'ment was war
 56 ye:s that is (PRT) now, m'ment what was
 57 ye:s that must be now, one moment what was

- 58 das jetzt, dee emm eff ne?
 59 that now, dee emm eff right?
 60 that now, dee emm eff right?

Ulf looks at Jo

- 61 (3.0)

*Jo turns head away from apparatus below
 Ulf's eye level and back to apparatus*

- 62 J Methanol dee emm eff eins, (.)
 63 methanol dee emm eff one, (.)

*Ulf and Jo look at the apparatus
 as their common focal point*

- 64 U das könnte man doch auch ganz norma:l
 65 that could one (PTR) also quite no:rmally
 66 one could also suck it out quite no:rmally
*Ulf looks Ulf points with his right
 at Jo hand to the apparatus*
- 67 so::, (.) unter, (.) Schutzgas absaugen.
 68 su::ch, (.) under, (.) protection gas suck out.
 69 like, (.) under, (.) protection gas.

*Jo turns head away from apparatus
 to his hands in which he holds a
 glass flask*

- 70 (2.0)

Jo turns eye gaze and head towards
glass flask in his left hand

Jo produces three slight horizontal
head shakes

- 71 J tz! ja: jetz hamwers eima hie:er.
72 ((irritated tone of voice))
73 tch! yea:h now have we it(NA) for once he:re.
74 tch! yea:h now we have it he:re for once.

75 (1.0)

works on glass flask in his hands

- 76 J 's: 'o' kein Problem=machn wir diese
77 it (PRT) no problem=make we this one
78 but it's no problem=we close this one

Jo looks at apparatus

- 79 J hier zu, (5.0)
80 here close, (5.0)
81 here, (5.0)
- 82 J tz! (0.5) die Scheise is natürlich
83 tch! (0.5) the shit is of course
84 tch! (0.5) the shitty thing of course
- 85 immer, (1.0)
86 always, (1.0)
87 is always, (1.0)

- 88 U dasda hinterher widdarauszuholn.
89 thatA there afterwards again fetch out.
90 to get this out again afterwards.

91 (2.0)

Jo looks towards apparatus

		_____		_____	
92	J	na:::in das	nich=	.hhh tz!	.hh pasa:u:w
93		no::: that	not=	.hhh tch!	.hh wa:tch
94		no::: not	that=	.hhh tch!	.hh wa:tch

*leans towards apparatus,
works on equipment*

		_____		_____	
95	J	laßuns das	ma	machn=	
96		let us that	(PRT) do=		
97		let's do it=			
98	U	=machnwiers	so:		°o°°kee.°°
99		=do we it like	tha:t		°o°°kay.°°
100		=let's do it like	tha:t		°o°°kay.°°