

Contributing to the elaboration of a design artefact according to one's interactional position: visual and audible evidence

Willemien Visser

► To cite this version:

Willemien Visser. Contributing to the elaboration of a design artefact according to one's interactional position: visual and audible evidence. SPSD 2010, the Studying Professional Software Design workshop, an NSF-Sponsored International Workshop, Feb 2010, Irvine, CA, United States. 2010. <inria-00530180>

HAL Id: inria-00530180

<https://hal.inria.fr/inria-00530180>

Submitted on 27 Oct 2010

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Contributing to the elaboration of a design artefact according to one's interactional position: visual and audible evidence

Willemien Visser
Department SES
LTCI-UMR 5141-CNRS-Telecom Paris Tech — INRIA
Paris, France
willemien.visser@telecom-paristech.fr

Abstract—This exploratory working paper examines the SPSPD2010 data from an interactional viewpoint. I analyse how two participants in a design meeting each contribute to the elaboration of the artefact.

In the SPSPD2010 data, something we see in all three pairs of designers is that one of the two designers majoritarily occupies the whiteboard (WB). This is particularly strong in the Anonymous meeting, where, with two exceptions, Male 1 writes and draws everything on the WB: he seems to mostly "control the floor". I will analyse how he does and how the other designer, that is, the one who rarely seems to hold the floor, Male 2, contributes to the progress of the design.

In this analysis, I focus on (1) the way in which the designers use various semiotic systems to express their contributions (cf. "multimodal interaction") and (2) the interactional position of each participant with respect to the floor. Designers' gaze and body posture receive particular attention.

Keywords—collaborative design; interaction; multimodality; gesture; gaze; body posture

I. INTRODUCTION

The present paper examines the SPSPD2010 data from an interactional viewpoint. I analyse how, through their interaction, two participants in a design meeting each contribute to the progress of their shared task, that is, the elaboration of a high-level design of a software system for a traffic signal simulator.

The SPSPD10 data deals with three pairs of designers. In each pair it is one of the two designers who majoritarily occupies the whiteboard (WB). This is particularly strong in the Anonymous meeting, where, with two short and small exceptions, Male 1 writes and draws everything on the WB. In this way, he seems to mostly "control the floor". I will analyse how he does and how the other designer, that is, the one who rarely seems to hold the floor, Male 2, nevertheless contributes to the progress of the elaboration of the design project.

In this analysis, I focus on (1) the way in which the designers use various semiotic systems to express their contributions (cf. "multimodal interaction") and (2) the

interactional situation and movements of each participant in the meeting regarding his¹ position with respect to the floor. Compared to my previous research on multimodal interaction in collaborative design, I pay particular attention in my analysis to two semiotic systems: gaze and body posture.

Presenting a draft version of my examination of these questions, this paper is an exploratory working paper, probably evoking more questions (at least from myself) than presenting answers.

a) Organisation of the paper. The paper has two main sections followed by a Conclusion. After a presentation of my approach to the analysis of interactional positions in collaborative design (section II), I present my "results", that is, for the moment being, a list of cases of different ways in which two persons X and Y, here exemplified by Male 1 and Male 2, position themselves with respect to the floor (sections III, IV, V, VI and VII). In VIII, the Conclusion presents questions that the analysis presented has evoked in me. It also formulates points to develop in the continuation of the beginning analysis presented in this paper.

For reasons of presentation (a problem with the available levels), sections IV, V, VI, and VII are four families of cases under III.

II. ANALYSING INTERACTIONAL POSITIONS IN COLLABORATIVE DESIGN: VISUAL AND AUDIBLE EVIDENCE

Before I introduce the approach adopted in this study to analyse designers' interactional positions in their collaborative activity, I present two short notes about (a) my qualification of the SPSPD2010 meetings as "collaborative design" situations and (b) "collaboration".

a) Analysing a dyadic interactional situation as a "collaborative" situation. I consider the SPSPD2010 meetings as instances of "collaborative design"—even if two participants in a meeting is the minimum condition to speak of

¹ Given that, in the data that I analyse, both designers are men, I will use "he" and "his."

"collaboration." The two designers have a shared task and, implicitly, they are supposed to collaborate on it.

b) "*Collaboration.*" A cognitive psychologist might expect "naively" that, in a "collaborative" situation, the different participants "work jointly on [the] activity or project" (Oxford dictionary, <http://www.askoxford.com/results/?view=dict&freesearch=collaborate&branch=13842570&textsearchtype=exact>). Social psychologists know that collaboration is (often) not such a pure enterprise where the contributions of the different participants are equally distributed. Several cognitive design studies of collaborative design have been introducing already more socio-cognitive oriented analyses, examining, for example, participants' roles in design meetings [1, 2].

Classically, in cognitive design studies—which constituted already an "advance" relative to the software design studies based mainly on software designers' output—researchers studied software design through protocol analysis, that is, the analysis of simultaneous or consecutive "verbalisation" [3, 4]. The request to "verbalise one's thoughts" or to "think aloud" is, however, only necessary for data collection on individually conducted activities. People working together do "naturally" express their thoughts. The analysis of the two families of corresponding corpora (individual and collective activities) requires different methods. In order to analyse collaborative design, we have developed the COMET method [5]. In several studies with D'Astous, Détienne and Robillard [6-8], we extended COMET in order to be able to distinguish different levels of interaction in a meeting, based on pragmatic linguistics' verbal-interaction analysis [9-11].

All these methods are restricted to verbal data. A new endeavour in which I have engaged these last years consists in extending the analysis of interactional data to that of other semiotic systems. With Françoise Détienne, we have developed a description language for the graphico-gestural activities in collaborative design meetings in order to examine the articulation between graphico-gestural and verbal dimensions in interaction [1, 12, 13]. Focusing on the *function* of gesture in design meetings, I have examined the use of gesture in such collaborative situations [14-17].

In the study presented here, I introduce still two other semiotic systems. In addition to designers' words, graphical (writing and drawing) and gestural actions, I also examine the role of gaze and body posture (making a distinction that clearly is possible only from an analytical viewpoint).

A. Floor

The way in which the concept "floor" is used in conversation-analysis studies is based on its meaning as "the part of a legislative assembly in which members sit and from which they speak" (the online presentation of the Compact Oxford English Dictionary, http://www.askoxford.com/concise_oed/floor?view=uk). From this acceptance of "floor", the term has come to refer also to "the right to speak in an assembly" (ibid.), which is underlying the way in which

Goffman [18] uses it when he defines the "floor" as "the acknowledged current-speaking right" (p. 129). The "ratified" speaker holds the floor. In my study, the person who is "holding—or controlling—the floor" is the one who determines the focus of attention for the participants in the meeting.

1) Back-channel feedback and floor

Many mechanisms play a role in the organisation of floor control (see also the next sub-section). Back-channel feedback is particularly important [19]. It supports the interaction and helps it move along. It is the work of those who *do not hold* the floor. Doing so, they signal that their attention continues to be present. How they proceed is strongly dependent on culture, in which language plays an important role. In English, people may use paraverbals such as "mhm", "aha", and "yes", "yeah" or "okay" (the last three used very much by Male 2 in the data I have analysed). Thórisson [20] gives as a "rule of thumb definition": back-channel feedback is "the ongoing (communicative) behavior of a dialogue participant that does not change who is in control of the dialogue at the moment" (p. 178). She gives this feedback also a more "active" role, however. Referring to evidence established by other researchers, she notes, "the absence of such regulatory gestures from a listener may disrupt the discourse" (p. 178). This means that X, in order to keep control over the floor, needs back-channel feedback from, at least, Y (if not also from Z and some other participants who are present). If only for that, Male 2 has an important contribution to the progress of the design project.

2) Floor and turn

Goffman [21] writes that he "ordinarily [reserves] the term 'turn' or 'turn at talk' to refer to an opportunity to hold the floor, not what is said while holding it" (pp. 270-271). In places he uses "speaking" for "what is said while holding [the floor], at other places he uses Sacks' locution "a turn's talk" [see his Note 14, p. 271, in 21].

Because "speaking" can lead to misunderstandings, I will use "a turn's talk".

B. Gaze and body posture

Gaze, gesture and body posture—and other modalities—are also important mechanisms used to take, to keep, and eventually to give over the floor [22, 23]. Generally, they are used together—and it is only from an analytical viewpoint that one can talk about "the role of gaze" or "the role of gesture". Of course, one particular modality can be, in a certain situation, the predominant modality underlying an interactional movement, for example, causing a change in attention. Kendon [23] has shown, for example, that gaze is a predominant modality used to signal the beginning and the end of a speaking turn, that is, to pass the turn (see, e.g., p. 33). For example, in order to begin, a participant looks away from the others, whereas at the end he looks to one or more other participants. However, in order to pass his turn, the participant can also drop off the volume or pitch of his speech—at the same time or instead of looking to another participant. A similar effect indeed can be obtained often by the use of various modalities. Participants can *request* a turn by raising a hand, for example, but also, more brusquely, verbally, by interjecting. A

participant can *take* a turn by making a gesture towards an object related to the common activity, but different from the current focus of attention. He can point, for example, to a maquette when his colleagues are discussing and looking to a drawing.

A person Y can take the floor, controlled until then by another person X, taking advantage of an elocutory pause in a turn's talk by X. A pause in a turn's talk by X can be of, at least, two types:

- X can be opening up to a contribution by Y, because X is ready to leave the floor to Y;
- X is not especially opening up to Y: he pauses only for elocutory reasons or to reflect.

Goffman [1964, as presented by 23] has shown that "it is through the mutually held gaze that two people commonly establish their 'openness' to one another's communications" [23, p. 23].

Neurophysiologic evidence for the important role of other modalities than gaze in signalling direction of attention is provided by Langton, Watt and Bruce [24]. The authors show the importance of cues such as head orientation and pointing gestures.

III. ANALYSING PARTICIPANTS' CONTRIBUTIONS DEPENDING ON THEIR INTERACTIONAL SITUATION: CASES

My starting point is the moment in which one participant, X—here Male 1—, takes the floor—that is, in the Anonymous meeting, 13 seconds after the start, at 05:29² (see Example 1). From this starting point on, I have analysed the video of the Anonymous meeting in order to identify the different types of situations that happen afterwards.

The four following sections (sections IV, V, VI, and VII) describe some ways in which two persons X and Y, here Male 1 and Male 2, position themselves with respect to the floor: especially, how X takes the floor, how he holds it, sometimes "opening up" to Y, how Y comes with a contribution, how Y reacts to X holding the floor, how X reacts to Y when he comes with a contribution.

a) *Formalism used in the examples of the different cases*. Based on Example n, I present the formalism that I will use in the text for the examples of the different cases.

0) Example n

Text text text If there is some text before the time stamped transcription, it is my presentation of the example.
 [0:08:17.4] Time stamp in the transcription. In the text, I will refer often to 08:17 (or, for moments after the first hour, to 1:12:09, e.g.)

[time stamp tx]

² I suppose that during the first five minutes of the meeting (from 00:00 until 05:16, when the first words are spoken—by the Interviewer, saying "Feels like school again"), the two designers read the Design brief.

Male N: Transcription of Male M's utterance [...] at tx, where [...] translates our cutting one or more words or even lines in the transcribed protocol
 {text text text} In or under the time stamped transcription there can be some comments that I formulate to make the transcription better understandable
 || in or at the end of Male M's transcribed utterance expresses that Male N interrupts him
 // in or at the end of Male M's transcribed utterance expresses that Male N talks at the same time as Male M

IV. X TAKES THE FLOOR

As noted above, Male 1 takes the floor right from the start, 13 seconds after the first words are spoken (by the Interviewer). He does so in the first utterance by one of the two designers (see Example 1).

0) Example 1 - Male 1 takes the floor

Following the Interviewer's opening remark "Feels like school again" (cf. Note 2), which provokes laughing by one or both designers, Male 1 says to Male 2, in a would-be "joking" tone (but in every joke...!), "Well, I want to start by hearing your summary of this." At "your summary....," Male 2 starts to laugh again.

[0:05:16.7]
 Interviewer: Feels like school again
 {laughing and agreement—"Yeah"—by one or both participant}
 [0:05:29.7]
 Male 1: Well, I want to start by hearing your summary of this {laughing by M2}
 [0:05:36.4]
 Male 2: Gotcha, well.

V. X HOLDS THE FLOOR

It is as a pair that Male 1 and Male 2 receive the design brief, are given an hour and fifty minutes to work on it, and are asked to create a high-level design of the system. They are given no additional instructions for this shared task, other than to use the whiteboard for any writing or drawing that they wished to perform.

As noted, right from the start, while the designers are not yet at the WB, Male 1 adopts a leading role (see Example 1). Therefore, he controls the floor already before he goes to the WB, where—with two very short and small exceptions (see below)—he will be the only one to draw and write.

0) Example 2 - Male 1 holds the floor

After a first answer by Male 2 in which he proposes the "summary" requested by Male 1 (see Example 1), Male 1 continues to "guide" the progression of the design project elaboration. He declares what they should keep in mind ("the big picture") and, first, where "{he}" always {wants} to start" (06:23) and, later, what seems to him "a good first attack" (08:17).

[06:23.7]
 Male 1: We need to think about the big picture. That's where I always like to start | Male 2: Yeah | {Male 1 continues} How do you see the code being—just kind of the structure of it being broken down? Just to get your thoughts.

Declaring that "It seems" to him, that, "a good first attack is just kind of ... a data analysis," Male 1 goes to the WB and starts to put down

some first elements. *In passim*, he says to Male 2 "Feel free to jump in." Male 2 also stands up, comes to the WB, goes back one moment to the table to get the Design Brief and then stays at the WB together with Male 1. Once in front of the WB, both Male 1 and Male 2 have at all times a marker in their hands.

[0:08:17.9]

Male 1: It seems like a, for this type of problem a good first attack is just kind of a, you know a data analysis [...] Feel free to jump in.—M2: OK!—We've got signals—M2 {*enthusiastically*}: OK!—, we've got roads, we've got cars, and now we have traffic

During the first five minutes when they are together at the WB (from 05:29 until 10:37, see Note 2), Male 1 makes it hard for Male 2 to take the floor. He keeps the floor, presenting a series of ideas concerning how to attack the problem and elaborating a first design representation.

Developing these ideas of his, he acknowledges more or less Male 2, but does not really listen to him, even less leaving him the floor.

In the following sub-sections, I will describe some of the ways in which a person X who holds the floor at a certain moment, here Male 1, interacts with his design-project partner Y, here Male 2.

A. *X forges ahead without leaving any possibility to Y to take the floor*

A first case is Male 1 forging ahead without leaving any possibility to Male 2 to come in and take the floor. An example is Male 1 asking a question, but continuing to follow his own thoughts, not listening or paying attention to Male 2's answer or other reaction (see Example 3).

Until 10:37, Male 1 does not really pay attention to Male 2. Even if he looks two times at Male 2 acknowledging his reactions, these glances seem as the involuntary reflex reactions when "something happens" in one's visual field. The first time is when Male 2 asks "do we really want that?" (see Example 4); the second time is when Male 2 says "I think it's more of a collection of signals" (see Example 10).

o) *Example 3. Male 1 asks a question, but forges ahead without paying attention to Male 2's answer*

Male 1 asks a question at which Male 2 reacts. Male 1 acknowledges Male 2's reaction (see below, Example 4), but he continues to forge ahead.

[0:09:47.0]

Male 1: So how are these signals?—trying to pull out our data. We've got cars, so there's a signal there... |
Male 2: There's at least one signal | // Male 1: Right | {*Male 2 continues*} there's at least one signal per direction at each intersection. Could be multiple, especially with the left_hand turn requirement.

[0:10:08.1]

Male 1: Yeah. These cars have a signal there, these cars have a signal there, and of course these have a signal. And the left_hand, this kind of implies—

[0:10:28.6]

Male 2: Really, it's just a—

[0:10:30.7]

Male 1: Two—two lanes? Is there a left_turn lane, or is it a suicide left?

1) *X reacts to Y's contribution with a formal acknowledgement*

Often, Male 1 verbally acknowledges Male 2's reactions, saying "Yes"/"Yeah," "Right," or "Okay" (see Example 3). Male 2, for example, may have answered a question or formulated an idea in reaction to something Male 1 did (that is, said, wrote or drawn on the WB). In many of these situations, Male 1's acknowledgement is more or less formal: Male 1 does not seem really interested by Male 2's reaction. Example 4 presents such a situation: Male 1's question seems more addressed to himself than to Male 2.

o) *Example 4. Male 1 asks a question that seems more addressed to himself than to Male 2*

At 9:10, Male 1 asks a question ("do cars equal traffic?"), but looks at the WB instead of at his partner. He gives himself the answer ("Maybe") and continues to work. Male 2 takes the question, however, as a "real" question and "interrupts" Male 1 with a reaction, coming up with a proposition (inaudible). Male 1 acknowledges Male 2's proposition, looking at him. Saying, with a drawling voice "Yeaeaeah!", Male 1 continues his own thoughts and is nearly unable to give any feedback upon Male 2's reaction (see also above, Example 3. *Male 1 asks a question but forges ahead without paying attention to Male 2's answer*).

[0:09:00]

Male 1: We've got signals—M2 {*enthusiastically*}: OK!—, we've got roads, we've got cars, and now we have traffic and so do cars equal traffic? Maybe—

[0:09:11.0]

Male 2: Kind of a twice {*inaudible*} do we really want that?

[0:09:13.0]

Male 1: Yeaeaeah, let's see what other data do we pull out

B. *X superficially "opens up" to Y*

Male 1' may seem to "open up" to Male 2 (e.g., asking a question, see Examples 3 and 4), but this can be only superficially.

When Male 1, at 08:50, presenting his ideas concerning how to attack the problem (see Example 2), says to Male 2 "Feel free to jump in" (to what Male 2 reacts enthusiastically: "Okay!"), his invitation seems superficial. He does not look at Male 2, for example. He doesn't pause, neither: it is *in passim* that he formulates his "invitation." He continues his presentation, leaving little space to Male 2 to "jump in" really.

An indication of X's lack of interest in Y's answer is that X does not look at Y. In Examples 3 and 4, Male 1 asks Male 2 a question without looking at him.

In the continuation of the interaction presented in Example 4, after Male 2's answer "Kind of a twice {*inaudible*} do we really want that?" Male 1 goes on with an implicit question or invitation for contributions. Male 2 reacts, but Male 1 carries on the development of his own ideas, talking at the same time as Male 2.

0) *Example 5. Male 1 seems to open up to Male 2's contribution, but does not pay any attention to what comes*

[0:09:22]

Male 1: ... let's see what other data do we pull out.
 Male 2: I think those were the main big players
 // Male 1: Intersections, I'm not sure if those are the same as signals?

C. *X "really" opens up to Y*

As noted above, it is only after five minutes of interaction (at 10:37) that Male 1 seems to start to listen and pay attention to Male 2—who has had already eight turns at that moment. When Male 2 says "So basically each entry...", Male 1 looks for the first time to him with awareness. Before, while Male 2 is saying "It says we have to have a protected left ...," Male 1 seems to begin to listen: he acknowledges Male 2's assertions, inserting various "Okays".

1) *X asks a question interested to get an answer*

Examples 6 and 7 present situations where, little by little, hearing Male 2, Male 1 becomes interested by what Male 2 says. In Example 7, Male 1, asking a question, is interested to get an answer.

0) *Example 6. Male 1 approves Male 2's contribution*

[0:10:30.7]

When, at 10:31, Male 1 says "Okay" to Male 2's assertion that "we have to have a protected left," he seems, for the first time, to pay "really" attention to Male 2's contribution and to approve it. As the transcription shows, he then consecutively intersperses Male 2's discourse with several expressions of agreement ("Okay," "Yeah").

Male 1: Two—two lanes? Is there a left_turn lane, or is it a suicide left?
 Male 2: It says we have to have a protected left | Male 1: Okay | {Male 2 continues} The requirements, | Male 1: Okay | {Male 2 continues} Yeah: be able to accommodate left_hand turns protected by left_hand | Male 1: Okay | {Male 2 continues} So basically each entry into the intersection there's going to be n number of signals | Male 1: Yeah | {Male 2 continues} And then... {Male 1 waits, and looks at Male 2} each signal's going to have a certain rule set to them.

0) *Example 7. Male 1 asks a question, interested to get an answer from Male 2*

At 16:20, asking his question concerning the signal synchronisation, Male 1 is looking to Male 2. He steps back from the WB and asks: "so does that occur in the intersection?" While Male 2 already reacts ("mhm"), Male 1 clarifies his question "As a containing data entity? Or conceptual entity?" It is then, when Male 2 answers, that Male 1 looks at him and listens attentively to him. His reaction to the content of Male 2's answer is positive, even enthusiastic (Male 1: "Exactly, exactly").

[0:16:20]

Male 1: so we have this behavior where somebody has to synchronize these signals, and so does that occur in the intersection? | Male 2: Mhm | As a containing data entity? Or conceptual entity?

[0:16:32.6]

Male 2: It sounds like more and more like the intersection is kind of {inaudible} because basically it's going to have given S1 goes green, it's going to have to delegate the actions of what S2 and S3 are; is it safe from stuff like that

[0:16:41.1]

Male 1: Exactly, Exactly. Somebody is controlling the interactions. If you think of this as kind of an encapsulated entity then it's not going to know about this.

1) *X is interested by Y's view or agreement*

Another example of opening up is to be interested by the other's view—or even by his agreement.

0) *Example 8. Male 1 is interested by Male 2's view*

[0:15:45]

Male 1: So it's interesting because the intersection has signals and the intersection has some control of the signals. The intersection needs to say that only one—only safe ones go on at a time so if these are green, these have to be red and so there's this kind of this hierarchy where the intersections own the signals and so we have this behavior where somebody has to synchronize these signals, and so does that occur in the intersection? | Male 2: Mhm | As a containing data entity? Or conceptual entity?

[0:16:32.6]

Male 2: It sounds like more and more like the intersection is kind of {inaudible}

At 16:20, Male 1 "explains" or resumes the state of the solution: "So it's interesting because the intersection has signals and the intersection has some control of the signals" (etc.). While he is talking, he looks to Male 2 and seems to wait for Male 2's agreement, or at least Male 2's view. Finally, he ends by a question to Male 2 and seems interested to get an answer (see Example 7).

A sign of interest in the contribution of one's colleague is to take into consideration this contribution (see Example 9).

0) *Example 9. Male 1 listens to Male 2 and takes into consideration his contribution*

While Male 1 is listing the Rules attached to the Signals, he comes up with "Time," which he writes down on the WB. Then Male 2 comes up with "Sensor," which Male 1 repeats, nodding, and writes down on the WB.

Male 1: So if we continue the hierarchy of the signals, the rules. There's time,

[0:13:38.2]

Male 2: Sensor_driven

[0:13:39.7]

Male 1: Sensor, and...

VI. Y COMES TO THE FLOOR

The next sub-sections present a series of situations where Y comes up with a contribution. Questions are: does he get the floor? If so, how does he manage?

A. *X has explicitly "given" the floor to Y*

Under "X 'really' opens up to Y", we saw some examples of Male 1 giving, more or less explicitly, the floor to Male 2—even if temporarily, for example, Male 1 asking a question, interested to get a reaction from Male 2, be it an answer or Male 2's view.

B. *Y comes with a contribution in a pause that X makes because he needs it*

Another situation is Y coming with his contribution in a pause of X, which is not a pause to give over the floor. This can be an elocutory pause or a pause that X needs to reflect (see Example 10).

0) *Example 10. Male 2 comes with his contribution in an elocutory pause of Male 1*

Because Male 1 is reflecting about what he shall do, he pauses in his activity (talking and writing/drawing). Male 2 immediately takes advantage of these pauses to come up with a contribution.

[0:09:32.5]

Male 1: Intersections, I'm not sure if those are the same as signals? {pause}

Male 2: I think it's more of a collection of signals because each intersection is going to have four—four sets of signals. // Male 1: Yeah. Exactly. {Male 2 continues} Whether it's one signal at each one or multiple.

[0:09:47.0]

Male 1: So how are these signals?—trying to pull out our data. We've got cars, so there's a signal there {pause}

[0:10:00.2]

Male 2: There's at least one signal—there's at least one signal per direction at each intersection. Could be multiple, especially with the left_hand turn requirement.

C. *Y gets the floor progressively*

When Male 2 gets the floor for the first time, it is progressively. It starts when, in answer to Male 1's question "is it a suicide left?," Male 2 proposes the "protected left" idea, which is approved by Male 1. M2 continues to develop the solution and Male 1 continues to approve (see Example 6), but he still looks to the WB. From the time on that Male 2 says, "So basically each entry into the intersection there's going to be n number of signals," Male 2 holds the floor during a moment. Several observations substantiate this change of floor from Male 1 to Male 2.

- Male 1 now looks at Male 2 with attention.
- At 10:56, Male 2 having said "And then," he pauses, and, while he does so, Male 1 waits and looks at him.
- Male 2 saying "So basically each entry..." talks with more assurance than before, as expressed by the force of his speech.
- While Male 2 talks, he does not look at Male 1, whereas Male 1 looks to him.

D. *Y interrupts X to take the floor*

In the sequence presented above (Example 10), it is possible that Y interrupts X to take the floor.

{WV: Requires other, clearer examples}

E. *Y introduces a new element in the design project*

One of the "classical" forms of contributing to a design project is to come up with a new "option" or "solution" (see the examples presented hereunder in Example 11). This is also a clear occasion to take the floor.

0) *Example 11. X proposes another option*

At 24:21, when they are discussing the left-turn question (a protected left, a left-turn lane or a "suicide left"), Male 2 proposes, "Other option is to make it a full two second lane." Male 1 listens to him, with attention and approves.

[0:23:54.1]

Male 1: So to keep it moving, what simplifying assumptions could we make initially and find those so that if this has a length, it never overflows, you know if ten, five cars can fit then it's all

[0:24:21.4]

Male 2: Other option is to make it a full two second lane. Don't worry about turning in, just have a full second lane here so that we have—that way we don't have that whole trying to figure out how what that length considered to the other part of the lane is and if you have a full lane everywhere in the intersection so everything fits they're two lanes at that point.

[0:24:37.6]

Male 1: It's two lanes, one of them

[0:24:38.9]

Male 2: Yeah—and then you just have dictate people waiting for that turn are going to pile up as if it was straight.

[0:24:43.5]

Male 1: Right

[0:24:46.5]

Male 2: I think it's a simplification

[0:24:57.0]

Male 1: Okay. I like that. Simplified there. So this is the left turn

Another form of contributing is to introduce a new concept or variable (see Example 12).

0) *Example 12*

At 17:40, when they are discussing "traffic" and Male 1 introduces "number of cars" as one of the traffic variables, Male 2 advances that he thinks that it is rather the "number of cars in period of time." Male 1 agrees (and writes "flow (t)" on the WB).

[0:17:40.5]

Male 1: Exactly. So what are the properties of traffic? Let's take that one out. Number of cars. Is that really the only thing?

[0:18:00.2]

Male 2: I think it's more of the number of cars in period of time, because I mean, there's a time element, because if the cars are stacking up at the intersection as opposed to free flowing in over twenty minutes.

[0:18:15.5]
Male 1: Yeah there's a flow, there's a flow of T over some function of time.

[0:18:19.4]
Male 2: Yeah, exactly.

F. Reaction of X to Y's contribution

Once Y has come up with a contribution, X can have various reactions. Globally, he can approve or disapprove Y's contribution. In the following sub-sections, I present different ways in which the designers express their approval of a contribution by their colleague. They can do so orally or visually, both still in different ways.

1) X approves Y's contribution

a) Orally

Verbally: "Yes"/"Yeah", "Excellent." It is Male 1 who mostly (48 vs. 17 times) evaluates (positively) his colleague's contributions. Male 1 qualifies as "Excellent," "Good", etc. Male 2's contributions, not v.v. (in addition, Male 1 also evaluates—positively—his own ideas).

Besides "Yes" / "Yeah" and "Okay", there are:

Exactly:	M1: 18;	M2: 9
Cool:	M1: 10;	M2: 1
Interesting:	M1: 6;	M2: 2
Makes sense:	M1: 2;	M2: 4
Good:	M1: 3;	M2: 0
I like that:	M1: 3;	M2: 0
Excellent:	M1: 1 ³ ;	M2: 0
Perfect	M1: 2 ⁴ ;	M2: 1
Absolute(ly):	M1: 1;	M2: 0
That is a great point	M1: 1	M2: 0
That's brilliant	M1: 1	M2: 0
<u>That's it</u>	<u>M1: 1</u>	<u>M2: 0</u>
Total:	M1: 48;	M2: 17

Male 2, to the contrary, is the one who mostly acknowledges his colleague's contributions. He nods and says, with more or less enthusiasm, "Yes" / "Yeah," approving softly Male 1's contributions (not yet counted; most interjected "Yes" etc. are not in the transcription).

0) Example 13. Male 1 approves Male 2's contribution with appreciating words

Some examples are the following.

[0:07:10.7]
Male 1: Cool, cool. Sounds good.

[0:09:32.5]

³ Male 1 repeats his positive evaluation:

[0:12:55.1]
Male 1: Excellent, excellent.

⁴ Once, Male 1 says not simply "Perfect," but "That's the perfect simplification."

Male 2: I think it's more of a collection of signals because each intersection is going to have four—four sets of signals. // Male 1: Yeah. Exactly

[0:12:50.1]
Male 2: Put this signal here and have you, have what rules attached to this to make a car go, not go.

[0:12:55.1]
Male 1: Excellent, Excellent.

[0:35:51.0]
Male 2: So that way the road would actually own what traffic it expects to be traveling on it.

[0:36:08.3]
Male 1: Cool, I like that.

[0:38:10.6]
Male 2: That's what I'm trying to figure out.

[0:38:12.6]
Male 1: That's interesting

[0:51:32.3]
Male 2: So which time—is this time for each one of these? Or is this the time between state changes? Because there are two different times. There's the time between a red light turning green—or is that just the time between all state changes? Are we saying those are equal?

[0:51:52.8]
Male 1: Good question.

0) Example 14. Male 1 evaluating positively his own ideas
We saw already an example of Male 1 evaluating positively his own ideas. In 8:17, Male 1 declares that "a data analysis" seems to him "a good first attack {...} for this type of problem."

0) Example 15. Vocalisation: "Mhm"
Male 2 is analysing the left-turn question. Male 1 follows and interjects some "Mhms", nodding (or only nodding).

[0:25:53.7]
Male 2: If we make the assumption that we're not going to have so a twolane road that turns into a one_lane road | Male 1: Mhm {nods} | I think we're fine | {Male 1 nods} | — well? Actually I [inaudible] should either. Because one lane is always going, is always | Male 1: Yeah {nods} | continuing through so if this is down to one lane you'd have one lane going straight, one lane feeding into the left_hand turn | Male 1: Yeah {lightly laughing} | which is I mean I think it's fine | Male 1: Yeah | its just..

[0:26:19.3]
Male 1: The left turn really introduces a lot of problems

[0:26:20.8]
Male 2: It does, yeah. But, I think—so what does the left_hand turn really mean though, it's just another—you're just basically turning from intersection to intersection | Male 1: Mhm {nods} | no matter what we do at this point, right? And so instead of going from intersection A to B, it'd be from A to C | Male 1: Mhm {nods} | . In the actual modeling of it. That's why I'm trying to think, the lanes aren't necessarily so important as which intersection does it get you to next | Male 1: Mhm

{nods} | ? And then how many cars are stacked up, which is going to be a method of, which is really the length is what we care. | {Male 1 nods} | Not so much length we care about, we actually care about the number of cars piled up.

0) *Example 16. Exclamation: "Ahh!"*

When Male 1 discovers in what Male 2 says the importance of "speed"—even if this is not exactly what Male 2 wanted to say—he exclaims "ahh." Male 1 writes down "Speed" on the WB, unattached to one of the other elements of the hierarchies that are already there.

[0:26:20.8]
Male 2: {...} Not so much length we care about, we actually care about the number of cars piled up.
[0:27:04.1]
Male 1: That fit.
[0:27:04.8]
Male 2: That fit, so
[0:27:05.8]
Male 1: Exactly, assuming these are correlated.
[0:27:06.5]
Male 2: Exactly, so I mean at that point then we care about length a little bit just for shear travel time.
[0:27:15.2]
Male 1: Ahh

b) *Visually*

Nodding

Example 16 showed several instances of nodding, accompanied or not by verbal approval. Another example is the following.

0) *Example 17*

[0:14:20.0].
Male 1: I think | Male 2: Okay | Left, Straight | Male 2: Yeah {nods} | because it could you know if you envisioned some sort of {inaudible} package | Male 2: Yeah {enthusiastic} | then there'd be sort of this {Male 2 nods enthusiastically} thing you know they'd drop a left_turn signal in cally - Male 2 nods enthusiastically - Male 2 nods there, and a straight signal. enthusiastically - Male 1}
[0:14:37.5]
Male 2: Yeah, that makes sense
Saying, "I think", Male 1 starts to write on WB. Male 2 says "Okay" and retracts from WB. Saying "Yeah", Male 2 nods. Male 2's "Yeah" after "package" is enthusiastic (idea: "You're COMPLETELY right!"). Male 1 looks at Male 2 and makes several gestures. Male 1 saying, "there'd be sort of this thing you know, they'd drop a left_turn signal in there, and a straight signal" Male 2 nods and nods, with much enthusiasm. Afterwards, Male 2 examines intensely the WB, nods in a reflective mode, and then says, with conviction in his tone, "Yeah, that makes sense."

VII. X AND Y SHARE THE FLOOR

In a collaborative setting, one would expect that it is not always the same partner who is holding the floor. There is, for example, an alternation between the different partners.

Example 18 presents such a situation; Example 18 presents the moment when such a real collaboration starts.

0) *Example 18*

Listing the Rules ... (having started with Time), Male 1 writes—and says—"Sensor" (see Example 9). While Male 1 is writing, Male 2 nods. After Male 1's "Sensor, and", both reflect, don't talk, don't write nor draw. Male 1 retracts from the WB. Both reflect, looking to WB. After that, Male 2 looks "into the sky," thinking. Next, Male 2 glances at the Design Brief and comes up with "Direction." Male 1 comes again closer to WB, but he does not write down anything. He may not be convinced, and Male 2 makes explicit "Left, Straight," tracing with his finger on WB the directions that the cars are supposed to adopt. When Male 2 says "Or is that—is that more of the signals?" Male 1 retracts again.

Male 1: So if we continue the hierarchy of the signals, the rules. There's time,
[0:13:38.2]
Male 2: Sensor_driven
[0:13:39.7]
Male 1: Sensor, and...
[0:13:58.5]
Male 2: Direction. Left, Straight. Or is that—is that more of the signals?

0) *Example 19*

The first period of collaboration where it is not one of the two who has the floor during a consecutive period, but where the control of the floor goes from the one to the other for rather short periods, occurs from 11:15 on. It starts when Male 2 interrupts Male 1 who says "Roads have lanes." Male 2 asks "Do we care?" (this part of the protocol follows the one presented in Example 6). Repeating AMle 2's question, Male 1 enunciates it more as a hesitation—even if the syntax is that of a question. They then start to discuss, talking while they look to the WB, but regularly looking at each other (vs. just one looking to the other). They use "I think," "I guess" and "because" in their discourse, presenting their ideas to the other as possible views that they are ready to justify, not as established truths.

[0:11:01.7]
Male 1: So we can sort of start with the hierarchy: intersections seem to have signals | Male 2: Yeah | . N of those. Roads have lanes
[0:11:15.5]
Male 2: Do we care?
[0:11:16.3]
Male 1: Do we care
[0:11:17.9]
Male 2: Because, I mean, unless we care because given a certain road you can have different lanes leading up to each intersection.

VIII. CONCLUSION

As announced in the introductory section, this working paper is a draft of a beginning analysis of the way in which the two members of a pair of designers each contribute to the elaboration of their design project. I have presented a series of cases, translating different ways in which a designer can occupy or come to the floor and in which his colleague can react upon this. I made this analysis using audible and visible indicators. Even if I lent considerably on visible indicators, such as gaze and body posture, the use I made of these visible

indicators has to be made clearer in my descriptions. In a next, more definitive version of this paper, I intend to do so, that is, to give a more explicit description of the way in which the designers use such visible modalities.

I announced in the introduction that there is one designer who seems to mostly occupy the floor, materialised by his monopolisation of the whiteboard and of the writing and drawing acts, mostly respected in all this by the other designer, that is, the one who rarely seems to hold the floor. One of my aims was to analyse how this other designer contributes nevertheless to the progress of the design project. I presented a series of examples implicitly showing this, but this question also requires still more analysis.

With respect to the questions examined here, quantitative analyses of the data seem difficult, if not impossible. Indeed, the designers are often not completely in the image and their face—and thus their gaze—is often invisible.

I formulated some hypotheses (some only implicitly), and proceeded bottom-up to support them through a description of cases. In a future analysis, I might formulate all my hypotheses explicitly and present more general evidence concerning them, generalising from the cases—in as far as possible.

REFERENCES

- [1] F. Détiennne and W. Visser, "Multimodality and parallelism in design interaction: Co-designers' alignment and coalitions," in *Cooperative systems design. Seamless integration of artifacts and conversations-Enhanced concepts of infrastructure for communication*, *Frontiers in Artificial Intelligence and Applications, Volume 137*, P. Hassanaly, T. Herrmann, G. Kunau, and M. Zacklad, Eds., English ed. Amsterdam: IOS. Also accessible at <http://hal.inria.fr/inria-00118255/en/>, 2006, pp. 118-131.
- [2] M. Baker, F. Détiennne, K. Lund, and A. Séjourné, "Etude des profils interactifs dans une situation de conception collective en architecture [A study of interactive profiles in a situation of collective architectural design] (ch. 6)," in *Méthodologies d'analyse de situations coopératives de conception [Methodologies for analysing cooperative design situations]*, F. Détiennne and V. Traverso, Eds. Nancy, France: Presses Universitaires de Nancy, 2009.
- [3] J. S. Gero and T. McNeill, "An approach to the analysis of design protocols," *Design Studies*, vol. 19, pp. 21-61, 1998.
- [4] N. Cross, H. Christiaans, and K. Dorst, Eds., *Analysing design activity*. Chichester, England: Wiley, 1996
- [5] F. Darses, F. Détiennne, P. Falzon, and W. Visser, "COMET: A method for analysing collective design processes," Institut National de Recherche en Informatique et en Automatique. Also accessible at <http://www.inria.fr/rrrt/rr-4258.html>, Rocquencourt, France, Research report INRIA 4258, 2001.
- [6] P. D'Astous, F. Détiennne, P. N. Robillard, and W. Visser, "Types of dialogs in evaluation meetings: An analysis of technical-review meetings in software development," in *Third International Conference on the Design of Cooperative Systems (COOP'98), Cannes, France, May 26-29*, F. Darses and P. Zaraté, Eds., English ed. Rocquencourt, France: Institut National de Recherche en Informatique et en Automatique, 1998, pp. 25-34.
- [7] P. D'Astous, P. N. Robillard, F. Détiennne, and W. Visser, "Quantitative measurements of the influence of participant roles during peer review meetings," *Empirical Software Engineering*, vol. 6, pp. 143-159. Also accessible at <http://hal.inria.fr/inria-001117298/en/>, 2001.
- [8] P. D'Astous, F. Détiennne, W. Visser, and P. N. Robillard, "Changing our view on design evaluation meetings methodology: A study of software technical review meetings," *Design Studies*, vol. 25, pp. 625-655. Also accessible at <http://hal.inria.fr/inria-00117060/en/>, 2004.
- [9] C. Kerbrat-Orecchioni, *Les interactions verbales*, vol. I. Approches interactionnelle et structure des conversations. Paris: Armand Colin, 1990.
- [10] C. Kerbrat-Orecchioni, *Les interactions verbales*, vol. II. Paris: Armand Colin, 1992.
- [11] C. Kerbrat-Orecchioni, *Les interactions verbales*, vol. III. Variations culturelles et échanges rituels. Paris: Armand Colin, 1994.
- [12] F. Détiennne, W. Visser, and R. Tabary, "Articulation des dimensions graphico-gestuelle et verbale dans l'analyse de la conception collaborative [Articulation of graphico-gestural and verbal dimensions in the analysis of collaborative design]," *Psychologie de l'Interaction. Numéro spécial "Langage et cognition : Contraintes pragmatiques"*, pp. 283-307, 2006.
- [13] W. Visser and F. Détiennne, "Articulation entre composantes verbale et graphico-gestuelle de l'interaction dans des réunions de conception architecturale [Articulating the verbal and graphico-gestural components of the interaction in architectural design meetings]," in *Actes de SCAN'05, Séminaire de Conception Architecturale Numérique [Digital Architectural Design Seminar] : "Le rôle de l'esquisse architecturale dans le monde numérique" [The role of the architectural sketch in the digital world]*, Français ed. Charenton-le-Pont, France. Disponible à <http://hal.inria.fr/inria-00117076/en/>, 2005.
- [14] W. Visser, "Function and form of gestures in a collaborative design meeting," in *Gesture in Embodied Communication and Human-Computer Interaction, LNAI*, S. Kopp and I. Wachsmuth, Eds. London: Springer, to be published.
- [15] W. Visser, "Characterising gestures according to their function in collaborative design," presented at GW 2009, the 8th International Gesture Workshop, Bielefeld (Germany), 2009.
- [16] W. Visser, "The function of gesture in an architectural design meeting (ch. 15)," in *About: Designing. Analysing design meetings*, J. McDonnell, P. Lloyd, R. Luck, and F. Reid, Eds. London: Taylor & Francis, 2009, pp. 269-284.
- [17] W. Visser, "Co-élaboration de solutions en conception architecturale et rôle du graphico-gestuel : Point de vue de la psychologie ergonomique [Co-elaborating architectural design solutions and the role of the graphico-gestural: The ergonomic-psychology viewpoint] (ch. 5.3)," in *Méthodologies d'analyse de situations coopératives de conception : Corpus MOSAIC [Methodologies for analysing cooperative design situations: The MOSAIC corpus]*, F. Détiennne and V. Traverso, Eds. Nancy, France: Presses Universitaires de Nancy, 2009, pp. 129-167.
- [18] E. Goffman, *Forms of talk*. Philadelphia: University of Pennsylvania Press, 1981.
- [19] V. H. Yngve, "On getting a word in edgewise," presented at Sixth Regional Meeting of the Chicago Linguistics Society, University of Chicago, Department of Linguistics, 1970.
- [20] K. R. Thórisson, "Natural turn-taking needs no manual computational theory and model from perception to action," in *Multimodality in Language and Speech Systems*, B. Granström, D. House, and I. Karlsson, Eds. Dordrecht, The Netherlands: Kluwer Academic Publishers, 2002, pp. 173-207.
- [21] E. Goffman, "Replies and responses," 1976.
- [22] C. Goodwin, "The interactive construction of a sentence in natural conversation," in *Everyday language: Studies in ethnomethodology*, G. Psathas, Ed. New York: Irvington, 1979, pp. v.
- [23] [A. Kendon, "Some functions of gaze-direction in social interaction," *Acta Psychologica*, vol. 26, pp. 22-63, 1967.
- [24] S. R. H. Langton, R. J. Watt, and V. Bruce, "Do the eyes have it? Cues to the direction of social attention," *Trends in Cognitive Sciences*, vol. 4, pp. 50-59, 2000.
- [25]