

## Mediated Pointing and the Corporeal Field

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**RESUME. Pointage médiatisé et le champ corporel.** « Pointer » est l'acte d'identification du référent réalisé en positionnant une partie du corps dans une relation de contiguïté avec lui. Cet article traite d'un cas particulier de pointage, accompli au moyen d'outils digitaux contrôlés par les mouvements de l'utilisateur. Il discute ce type de référence par rapport aux définitions des gestes de pointage présentes dans la littérature. Cette discussion se fonde sur l'analyse d'occurrences observées de pointages médiatisés, constituées d'enregistrements vidéo de personnes pointant vers des objets digitaux sur un écran d'ordinateur grâce à une flèche contrôlée par une souris. L'analyse qualitative de ces exemples et le recours à diverses techniques de transcription montrent que lorsque l'utilisateur connaît le dispositif, son corps et l'outil ne constituent pas deux entités séparées mais sont une seule unité hybride dotée de ses propres coordonnées spatio-temporelles, produisant des actions non-verbales synchronisées avec la parole. Par conséquent, dans une perspective pragmatique, on peut considérer le pointage dans un espace digital avec un outil contrôlé par le corps comme un vrai geste de pointage, produit par un champ corporel augmenté. En intégrant le corps humain et les prothèses techniques, l'utilisateur peut être présent et agir sur des espaces par ailleurs inaccessibles.

**Mots clés :** pointage médiatisé, champ corporel, référence spatiale, pointage non-punctuel, co-présence.

**ABSTRACT.** 'Pointing' is the act of identifying a referent by positioning a body part in spatial contiguity with it. The present paper considers the case of pointing performed with the aid of a digital tool controlled by the user's movements, to discuss its nature against the background of current definitions of pointing. The discussion is supported by an examination of actual occurrences of mediated pointing, including video-recordings of people who point at digital objects on a computer screen with a white arrow controlled by their mouse. The qualitative analysis of these examples, and the use of various transcription techniques, suggests that when the user is familiar with the device, body and tool are not separate pieces, but a whole hybrid unit with its own spatio-temporal coordinates, that produces nonverbal actions synchronized with speech. Therefore, from a pragmatic perspective, pointing in a digital space with a device controlled by the body can be considered as a genuine pointing *gesture*, produced by an augmented corporeal field. By integrating the human body with technical prostheses, the user can be genuinely present on spaces otherwise inaccessible.

**Key words:** mediated pointing, corporeal field, spatial reference, non-punctual pointing, presence.

### 1. INTRODUCTION

The study of pointing has attracted increasing attention recently, confirming a renewed interest in the body as a semiotic resource. 'Pointing' occurs when the position of a referent is conveyed by contiguity with a body part (arm, fin-

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ger, eyes, head or lips) playing the role of an index. Recent studies have agreed that this act is not as simple, natural, and straightforward as it may appear superficially. Scholars have illustrated that for a body part to work effectively as an index, it must rely on a complex system of situated coordinates: a vector departing from the body limb and oriented in the direction of a referent (Clark, 2003), an activity system necessary to detect the relevant target out of a series of possible candidates (Goodwin, 2003), and an array of morphological variations conveying semiotic aspects, such as the status of discourse (crucial or accessorial), oppositional properties of the target (single or collection, site or direction, closeness or distance), or epistemic stance (precise or vague) (Kendon and Versante, 2003; Haviland, 2003; Wilkins, 2003). Pointing is also shaped by the cultural resources of each community, such as absolute versus relative spatial coordinates (Levinson, 2003) or specific cultural frames (Hanks, 1990). Finally, pointing may be merged in fluid combination with iconic gestures resembling the form of the referent (Goodwin, 2003). The identification of these aspects has been made possible by the qualitative observation of pointing gestures with an approach drawing on both a pragmatic tradition, which considers pointing as an action and the context as a crucial component of its meaning, and an ethnographic tradition, which analyzes actual occurrences of pointing gestures and their ties to the situational resources. Thanks to this approach, pointing has emerged clearly as an articulated cultural practice, reflecting a rich array of situational circumstances.

With digital technologies, the repertoire of available indexes has expanded beyond 'natural' ones such as fingers and eyes, to include common tools, such as the laser pointer, or more sophisticated tools, such as virtual hands. The range of possible targets has also expanded beyond natural ones, to include anything from images projected on a screen, to remote operating rooms. The study of pointing with the aid of a technical tool, henceforth mediated pointing, is usually undertaken with such practical aims as to compare devices (Poupyrev, Weghorst, Billingham, and Ichikawa, 1997, 1998; Balakrishnan, 2004), or to focus on perceptual-motor parameters (Douglas, Kirkpatrick, and MacKenzie, 1999; MacKenzie, Kauppinen, and Silfverberg, 2001). Oviatt, DeAngeli and Kuhn (1997) have adopted a quantitative approach to investigate the use of mediated pointing and the way in which it is combined with other referential resources. Pragmatic, situated studies have highlighted the limits of mediated pointing with respect to natural pointing and face-to-face settings (Hindmarsch, Fraser, Heath, Benford, and Greenhalgh, 1998; Schmauks, 1987). In this paper, we will not evaluate the effectiveness of mediated pointing, but examine its pragmatic structure compared with the structure of bodily pointing. The discussion will be anchored to actual instances of the phenomenon, extracted from a collection of video-recorded sessions, and relating to mediated pointing produced by a device controlled by the user's body. The purpose will not be to produce general statements on the pattern of this phenomenon across individuals, but to match the current definition of pointing with these actual instances.

The video-recorded sessions from which the examples are extracted show a participant and a researcher sitting in a laboratory in front of a computer monitor, with a series of scenes alternating on the screen, like the one in Figure 1. In reply to some questions from the researcher (e.g. Where is the red pyramid?), the participant produces spatial references to the objects in the virtual scene and points to them with the white arrow controlled by the mouse.

The mouse is chosen as a pointing device because of its familiarity. All sessions are video-recorded with the split-screen technique, displaying the events in the virtual and real environment side-by-side on the same monitor (Gamberini, and Spagnoli, 2003).



Figure 1. The split screen, showing the virtual scene (on the left) and the laboratory (on the right).

Following an approach that extends conversation analysis to the analysis of non-verbal actions and gestures (Heath, and Hindmarch, 2002), we will focus on the sequential unfolding of actions, and on their contextual resources. The examples will be presented in the form of transcripts, constructed according to the classic Jefferson's code of Conversation Analysis (Appendix), and reporting any sound produced by the speaker, including pauses, overlaps, hesitations, and stuttering. The Jefferson's code "is particularly useful for capturing aspects of speech production and the temporal positioning of utterances relative to each other" (Wooffitt, 2005, p. 11). The verbal exchanges are in Italian, accompanied by an idiomatic translation in English. The transcripts also report people's non-verbal actions, by describing relevant changes in their physical position, the progression and spatial orientation of their pointing, and any environmental event relevant to the actions described. When required, multimodal transcripts are offered, showing pictures of the events and borrowing the rationale from a music score, so that different kinds of events are put in separated, dedicated lines and referred to a common timeline ('pentagrams,' Gamberini, and Spagnoli, 2003). Squared brackets in the transcripts show the insertion point of an event with respect to those reported in the previous/following lines (unimodal transcripts), or with respect to the timeline (pentagrams). The video clips of the examples are also available on the Internet (<http://psicologia.unipd.it/htlab/217.php>).

The rest of the paper will be divided as follows: first, the characteristics of a pointing gesture according to current definitions will be illustrated (Section 2). Then, we will analyze the nature of the unity constituted by body and pointing tool (Section 3-4), and discuss whether mediated pointing unfolds along an organization similar to that of natural gestures (Section 5). The final section contains the conclusions.

## 2. THE PRAGMATIC UNITY OF THE BODY + THE MOUSE

Let's start with one example of 'mediated pointing.' The participant and researcher sit in front of a table, looking at a computer monitor; the participant uses a mouse as the pointing device. The scene on the computer screen shows two objects, a red and a green pyramid (Figure 2).



Figure 2. Screenshot of Fragment 1 at line 1, with the laboratory on the right and the virtual scene on the left.

When the scene appears, the following conversation occurs:

### Fragment 1 [MM 6]

- 1 Researcher: e::: ↑dove si trova la piramide rossa?  
u where is the red pyramid?
- 2 Participant: ((the white arrow moves  
from the green pyramid to the red one,  
3 reaches it, stops,  
4 [adjusts position, stops])  
5 [in fondo:, (.) a de°stra°.  
at the bottom to the right
- 6 Researcher: °(occhei).°  
okay

The researcher asks “u where is the red pyramid?” and then the participant moves the mouse and says “at the bottom to the right.” These acts performed by the participant are constructed as relevant to the question: they follow the question, are produced by the person who is expected to provide the answer, and supply the required information, namely the spatial position of the red pyramid. The reply consists of non-verbal (italics in double parenthesis) and verbal resources. The verbal ones provide the spatial position of the red pyramid by way of explicit coordinates (or ‘frames of reference,’ Levinson, 2003); the nonverbal ones locate the referent in its context by approaching it with an index (the white arrow). As we see from the squared parenthesis in lines 4 and 5 of the transcript, the verbal part is in synchrony with the non-verbal, since it begins once the index has reached the red pyramid. Pragmatically, they both

converge to perform one sole action, an answer. Its development can be better appreciated from Figure 3, which displays a series of frames from the video-recording of the episode, and a timeline. As the arrow shifts, and finally stops in proximity to the red pyramid, both interlocutors are staring at the common visual field. Once the referent is located non-verbally, the participant adds the verbal coordinates (“*at the bottom to the right*”).

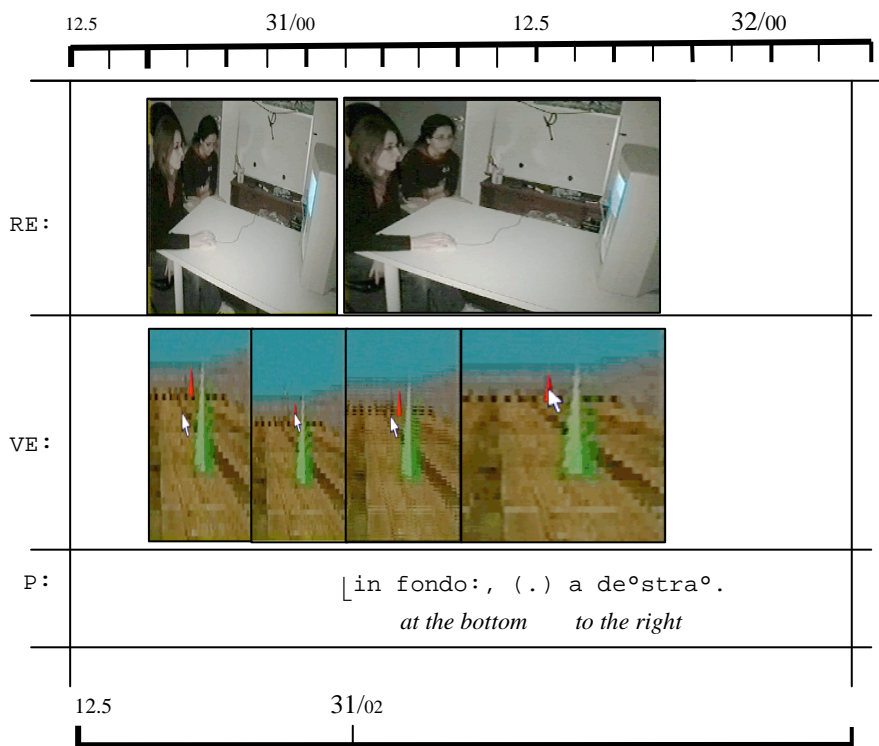


Figure 3. Phases in the movement of the white arrow controlled by the mouse, as described in fragment 1, lines 2-5 (RE=Real Environment, VE Virtual Environment, P=Participant).

Is this indexical reference a proper ‘pointing’? Pointing is an indexical gesture with which a person orients a body part towards a target in order to identify it as the referent (Kita, 2003).<sup>1</sup> In other words:

- a) It is performed with a *body part* working as an index;
- b) The body part is *spatially positioned* in contiguity with the target object;
- c) The positioning is recognizable to the interlocutors, thanks to the construction of a common ground (see for example Mondada, this issue).

The second and third characteristics are easily recognizable from the example: the white arrow is positioned close to the referent; the participant and user can easily see this action and interpret the frames of reference (‘right/left’) in terms of the speaker’s position. The presence of the first characteristic is more dubious, for there is no ‘body part’ working as an index. However, the white arrow does not move of its own accord, but is controlled by the participant’s hand. We then argue that a body part is involved in this mediated pointing and is essential to it. First, the indexical reference in Fragment 1 is produced by the

participant's hand *and* the white arrow together: the bodily movement is not able to provide the spatial identification of the referent, and the arrow's movement needs to be attributed to the designated respondent in order to count as her reply. Therefore, even though different spaces seem to be involved, the hand controlling the mouse and the mouse controlling the arrow, just one indexical reference is produced. Second, to speak of "the hand controlling the mouse and the mouse controlling the arrow" is inaccurate. Except, maybe, when some breakdown occurs, for example when the device ceases to work well, or during a learning phase when the user is unfamiliar with a new technical tool, a tool is used 'transparently,' because the focus is not on using the tool *per se* but on the actions performed with it (Winograd, and Flores, 1987). Pointers can have different modalities of relating with the body; they can move more or less analogously to the body, they can have an origin closer or farther from the pointing person (in natural pointing the origin is in the body of the pointing person), or have the origin more or less influenced by the position of the pointing person (in natural pointing the pointer cannot be positioned independently of the whole body). The union of the body and the tool allows specific actions that are not attributable to any of the two separately. In this sense, instead of referring to the 'body', we will follow Hanks (1990) and refer to the 'corporeal field'; a corporeal field defines the body in terms of action possibilities resulting from the technical and cultural resources available to it and allowing the involvement with specific objects in recognizable ways. The next section will examine the corporeal field comprised by the body plus the pointing device, and its affordances.

### 3. THE AFFORDANCES OF THE POINTING TOOL

Any indexical gesture relies on an indexical ground (Hanks, 1990), namely on 'a set of coordinates more complicated and more abstracted than the speakers' physical location' (Hanks, 1990, p. 39), providing the framework against which the gesture can be interpreted. A crucial element in this indexical ground is the spatial relation of contiguity between the index and the referent. Achieving this spatial contiguity implies the use of the spatial affordances of the pointing tool, and depends on the user finding a meaningful way to use the spatiotemporal characteristics of the index to highlight an object on the digital space. The simplest way is probably through Punctual Pointing (PP), performed by moving the index in the direction of the referent, and then by stopping it in proximity to the referent; it is not until the end of such movement that the referent is identified.<sup>2</sup> As in Fragment 1, a PP highlights the location of the referent. A more complex way is *non-Punctual Pointing* (nPP) (Schmauks, 1987), which uses the index creatively, exploiting the way in which it can be moved around to highlight some characteristics of the referent. For instance, in natural pointing, the hand and orientation of the palm can be used to point at the surface of a referent. Not yet an iconic gesture, nPP is used to index some characteristics of the referent that punctual pointing would not highlight because of the spatial limits of the index. Fragment 2 provides an example of nPP realized through a technical tool. The setting is always the same as in the previous fragment, but the participant is different, as is the position of the red pyramid on the digital scene (Figure 4).

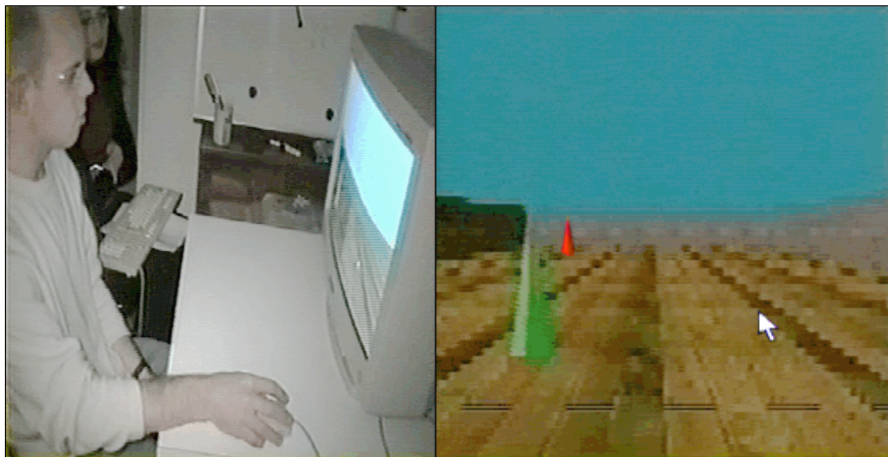


Figure 4. Screenshot of Fragment 2 at line 1, with the laboratory on the left and the virtual scene on the right.

The researcher asks the participant what he is seeing, and the participant describes the virtual scene in front of him.

Fragment 2 [MM 22]

- 1 Participant: [una stanza fatta tutta di: e::  
*A room all made of u*
- 2 [((Moves the arrow circularly over the 'room';  
 3 stops the arrow))
- 4 [pavimento tipo: ↑legno  
*floor kind of wooden*
- 5 [((shifts the arrow to the right,))
- 6 [mi sembra,  
*I think*
- 7 [((moves it vertically))
- 8 Researcher: uhu.
- 9 Participant: ((keeps shifting the arrow vertically towards  
*one edge of the wall*
- 10 [shifts the arrow all along the wall))
- 11 [e una parete in: mattoni.  
*and a brick wall*

Both the participant and researcher are looking at the monitor. The participant describes one by one the elements of the digital scene he is looking at, accompanying the descriptions with movements of the arrow controlled by the mouse. The participant's arrow reaches the referents and moves around them in a manner that is not casual and not a simple adjustment. The direction of the movement highlights some spatial characteristics of the referents, thereby distinguishing each of them from the other. Let's consider them by way of a multimodal transcript of the 'pentagram' type. The first three frames in Figure 4 accompany the user's utterance "A room all made of u" (lines 1-3 in the transcript), and show the arrow moving widely and circularly. The ability of the pointer to move in any direction on a bi-dimensional plane on the screen is exploited in a way appropriate to the discursive context: with this continuous circular movement, the small arrow can create a relation of spatial contiguity

with the whole room, instead of a single element in it, as would happen with a punctual pointing.

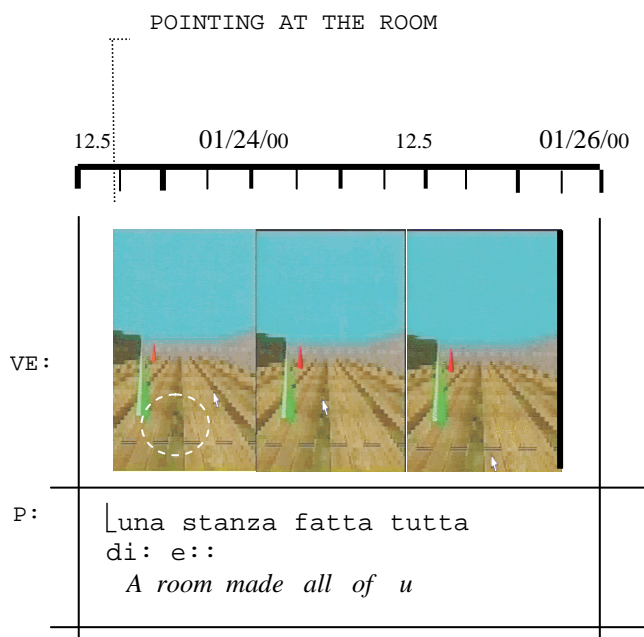


Figure 5. The non-punctual pointing at the room (VE=Virtual Environment).

In the first frame of Figure 6, we see that the participant after a word search (“e:”), has a new referent, the floor, which is more confined an object than the whole room and extends only on the horizontal dimension. While the participant says “*floor kind of wooden*”, he moves the white arrow horizontally and shortly. In the last four frames of Figure 6 we see the movements that accompany the new utterance “*and a brick wall.*” The arrow follows the line of the wall, higher on the screen, and moves horizontally with longer traits..



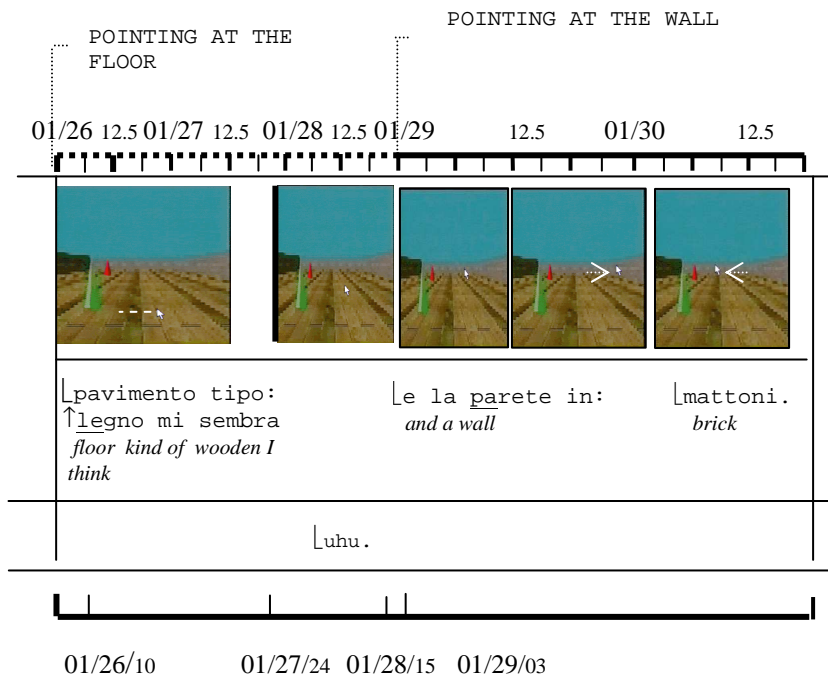


Figure 6. The non-punctual pointing at the floor and at the wall (VE=Virtual Environment).

In summary, the participant exploits the possible movements of the tool to point at a different spatial configuration. The way of using the pointer is not prescribed by the pointer itself, is not a mere consequence of the hand movement on the mouse, but a result of the hand – and the mouse – operating together. The user’s actions exploit the spatiotemporal characteristics of the body connected to the mouse, and acknowledge the affordances of this hybrid unity (Spagnoli, Gamberini, 2005). This allows the user to actually enter and move on a space, the digital space, which would be inaccessible to the body alone. In the following section we will analyze a fragment in which the user explores the difference between the affordances of the body+mouse and the affordances of the body alone.

**4. EXPLORATIONS**

The mediated pointing has its own, peculiar spatiotemporal affordances, which differ from those available to the bare body operating on natural objects. The following fragment shows a participant switching between natural gesturing and mediated pointing, in an attempt to produce a satisfying spatial reference. In doing this, he tries out different arrangements of the corporeal field, from natural to mediated, and different affordances.

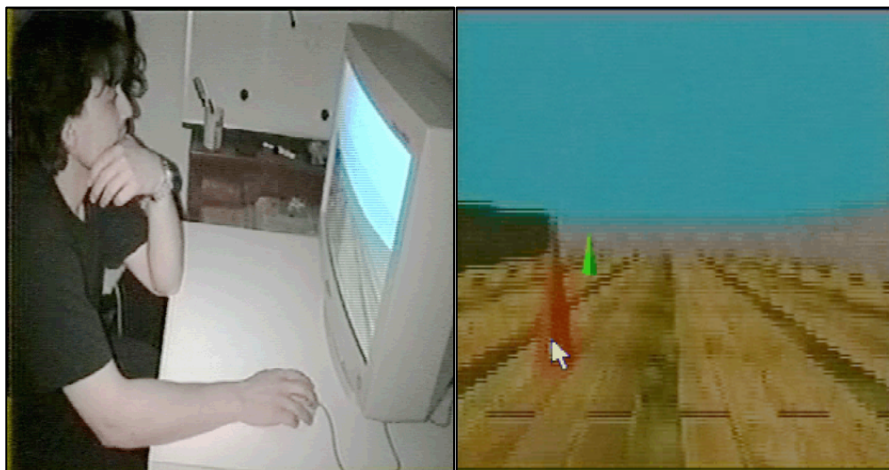


Figure 7. Screenshot of Fragment 3 at line 1, with the laboratory on the left and the virtual scene on the right.

### Fragment 3 [MM 23]

1 Researcher: e adesso? (.)  
*and now?*  
 2 [ >dove si trova la piramide rossa<? ]  
*where is the red pyramid?*  
 3 Participant: [ ((shifts the arrow towards the red pyramid, ]  
 4 *adjusts it)*  
 5 u:  
 6 ((extends the left arm forward,  
 7 *[moves it back and forth,)*  
 8 [davanti  
*in the front*  
 9 [ ((repeats the last part of the movement))  
 10 [a sinistra.=  
*to the left*  
 11 = ci[òè::  
*I mean*  
 12 [ ((leaves the mouse with the right hand,  
 13 *and puts the hand in front of him,*  
 14 *holds the mouse again.))*  
 15 m:  
 16 ((arrow shifts circularly around red pyramid))  
 17 [leaves the mouse with his right hand  
 18 [ >come dire<  
*how can I say*  
 19 ((right hand back on the mouse))  
 20 [ ((arrow forms wide circles around red pyramid))  
 21 [↑in una posizione prima della della:  
*in a position before the the*

20 [piramide:  
 pyramid  
 21 [((moves the arrow towards the green pyramid,  
 22 [touches it))  
 23 [verde.  
 green  
 24 [((arrow moves halfway between the pyramids))  
 25 Researcher: [sì:  
 Yes  
 26 Participant: °quindi°  
 So  
 27 ((Moves the arrow closer to the red pyramid))  
 28 più vicino a me.  
 Closer to me  
 29 ((arrow moves to the center of the screen))  
 30 Researcher: okay.

Let’s consider the participant’s attempts from line 1 to line 25. The spatial coordinate that he wants to convey is the frontal position of the red pyramid with respect to the green one; while nonverbally this coordinate is formulated since line 8, several attempts are needed before the participant is satisfied with the nonverbal rendition of this coordinate. At the beginning, the participant points the white arrow at the red pyramid, with small adjustments (Figure 8).

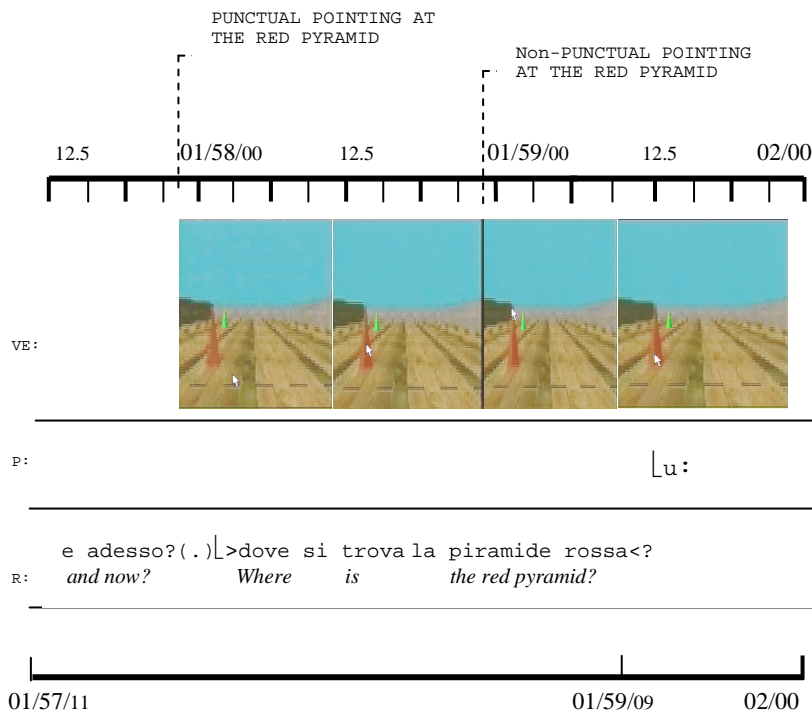
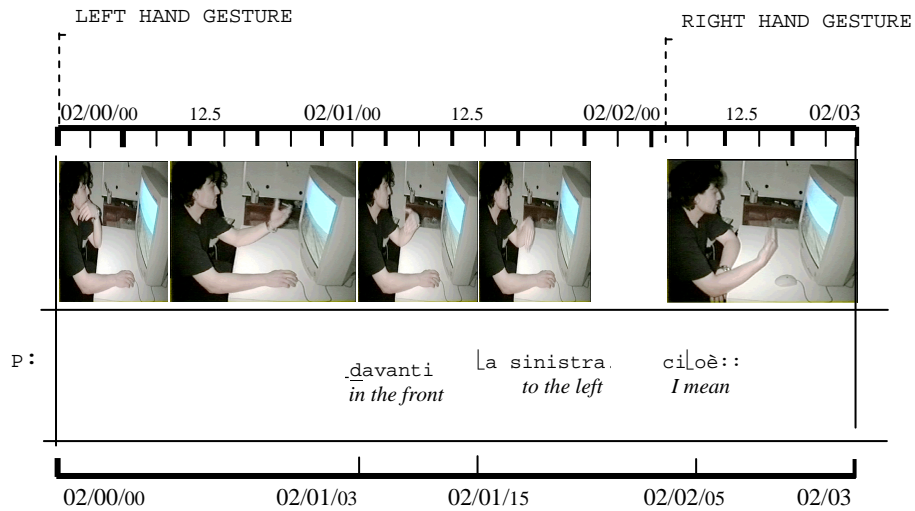


Figure 8. The participant points at the red pyramid (VE=Virtual Environment, R=Researcher).

Then, anticipated by a “u:”, he gestures with his left hand, moving it back and forth on the sagittal axis, in partial overlap with the verbal reply “in the

front” “to the left.” Then, he says “*I mean*”, showing that he is about to reformulate the reply again, and produces the same movement back and forth with the other hand, the palm in front of him (Figure 9).



Then he anticipates again the imminence of another reformulation “*how can I say*” and goes back to the mouse – probably in compliance with the original instructions of pointing with the mouse. The arrow moves circularly around the red pyramid in a non-punctual pointing, emphasizing more than the red pyramid itself, the pyramid’s “in front of” plane. Then he stops and re-starts, with more emphasized circles and a description that contains a frame of reference (“*in a position before the*”) and the *relatum* (“*green pyramid*”)³. While he names the *relatum*, he points at it with the arrow, in a spatial movement that connects the area around the red pyramid with a reference point, and that is able to make visible the relation between the two objects (Figure 10).

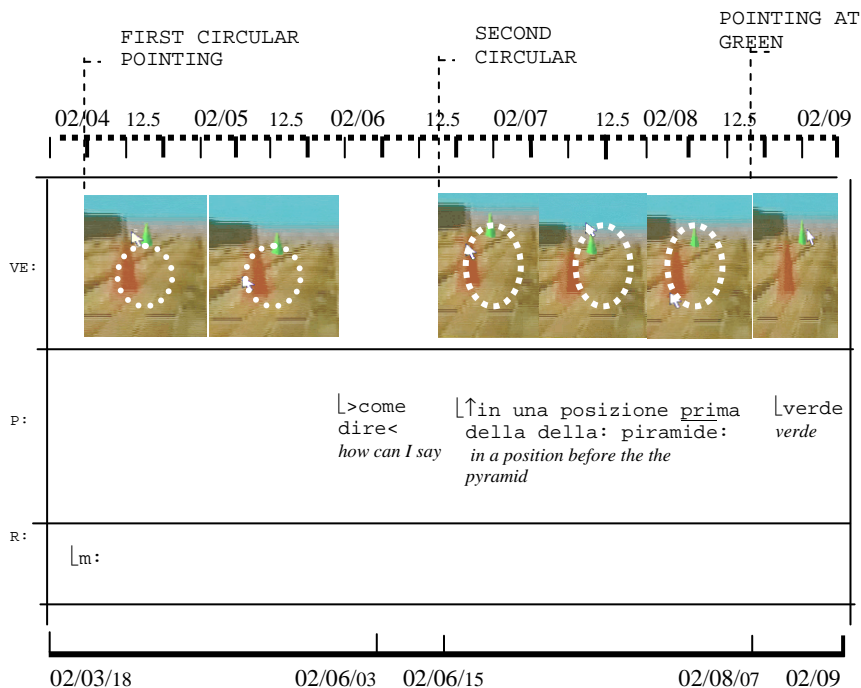


Figure 10. The participant produces two non-Punctual Pointings with the white arrow

The researcher has not solicited any correction from the participant; it is the participant who keeps supplying additional spatial references in reply to the same question, by using different pointing solutions. This fragment is interesting because various affordances of the mouse are explored before the final nPP is able to express the coordinate contained in the frame of reference, by identifying a spatial relation and not a spatial location.

### 5. MEDIATED POINTING AS A GESTURE

In gesturing, the person has to carefully orchestrate the temporal development of her movement: its beginning and end, its pace and phases, which may all be interpreted by the interlocutor as contributing to the final meaning. In this section, we will consider this temporal modulation in the Fragments analyzed so far; in particular, we will focus on those temporal aspects that have been identified as critical for natural gestures, namely their phases and their synchronization with speech.

#### 5.1. Phases

According to MacNeill and Duncan (2003), a gesture unfolds along three stages: a preparation, a stroke and a disengagement. In Fragment 1, the white arrow prepared the gesture by starting the movement towards the red pyramid, namely towards the position from which the gesture can occur (Figure 11, first frame). This communicated to the interlocutor that a gesture, then a reply, was about to follow. In the second frame, the pointing reached the stroke, namely the contiguity with the referent. Once the arrow reached the referent, the participant started giving the verbal coordinates (“at the bottom to the right”) and

kept the arrow on the referent, with small adjustments (second and third frames).

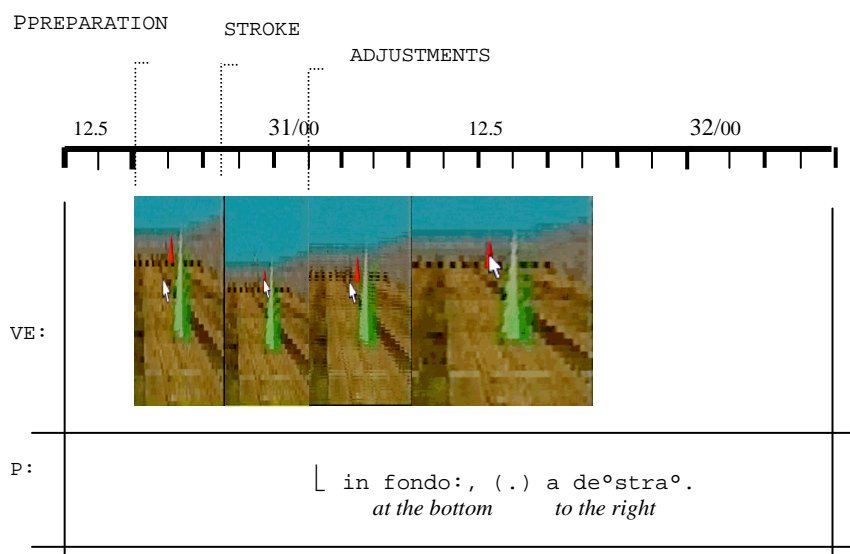


Figure 11. The preparation and stroke of a mediated pointing.

In Fragment 3 analyzed above, the end of the mediated pointing was marked. The participant cleared the indexical space by dragging the arrow in a central area in the virtual scene, out of the area used during the spatial reference (Figure 12). This operation occurred twice, after each spatial reference (“*in a position before the green pyramid*” and “*Closer to me*”), and disengaged the arrow from the referential function.

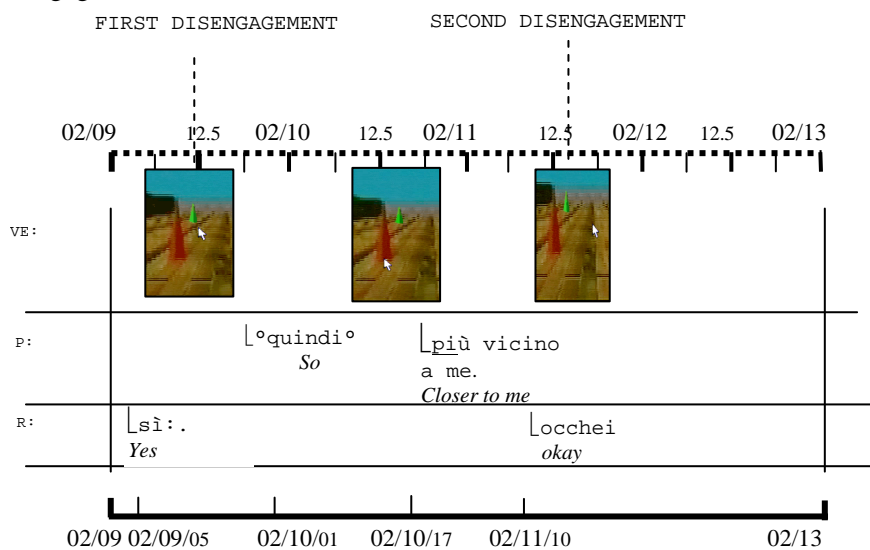


Figure 12. The marked disengagement of the pointer from the indexical act

The cases of mediated pointing analyzed here develop along phases very similar to those observed in natural gestures. Maybe what is typical of medi-

ated pointing is the need for small adjustments once the arrow has reached a position close to the target. We will discuss this point in section 5.3.

### 5.2. Synchronization

The meaning of a gesture is expressed during the stroke; utterances whose meaning is connected to the gesture are usually produced simultaneously with the stroke. This synchronization is such a regular practice to the point that either the speech or the gesture can be delayed until the other modality is ready to convey the associated meaning. The same effort towards coordination is at work in the mediated pointing we have observed so far. For example, in Figure 11 we saw that the verbal reply (“at the bottom to the right”) was provided only when the white arrow reached the target. When the position of the red pyramid was described, the index was already contiguous to it, both resources converging on a simultaneous spatial reference. What happens to this coordination when the pointing is non-punctual? In Fragment 2, the participant was describing the virtual scene. The first referent was the room and the arrow moved around in circles covering a wide area, the room’s floor. As the participant tried to define the material of which the room was made, he produced a prolonged sound (“u:”) while searching for a word. Then the verbal production stopped completely, and so did the arrow’s movement.

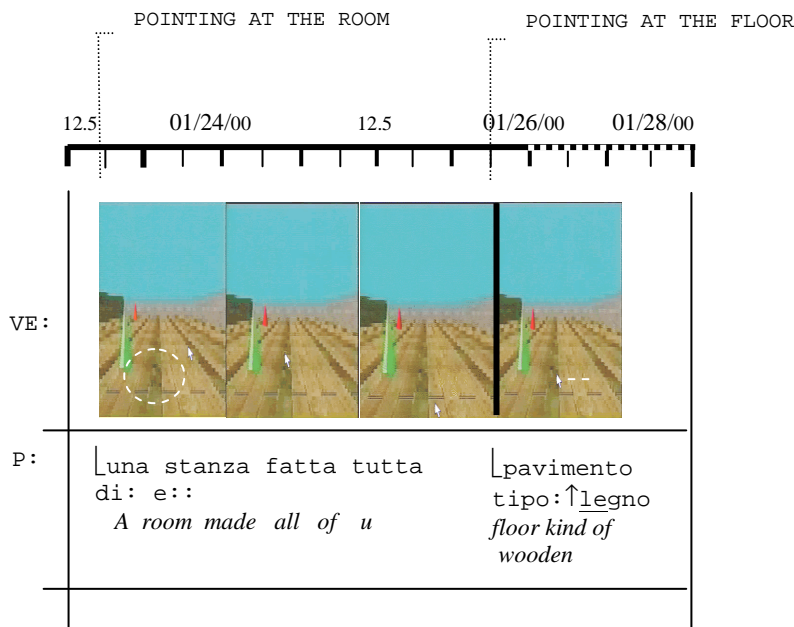


Figure 13. The mediated pointing waits for the verbal description.

As the speech resumed, the referent changed (from the “room” to the “floor”) and the participant was able to find an appropriate description for the material (“wooden”). Concomitantly, the pattern of the arrow’s movement changed, no longer highlighting a wide circular area, but a horizontal, short one. Likewise, at the end of the fragment, the participant delayed the verbal description (“and the brick wall”) until the preparation of the pointing was completed, and the index was contiguous to the referent (the wall) (Figure 14).

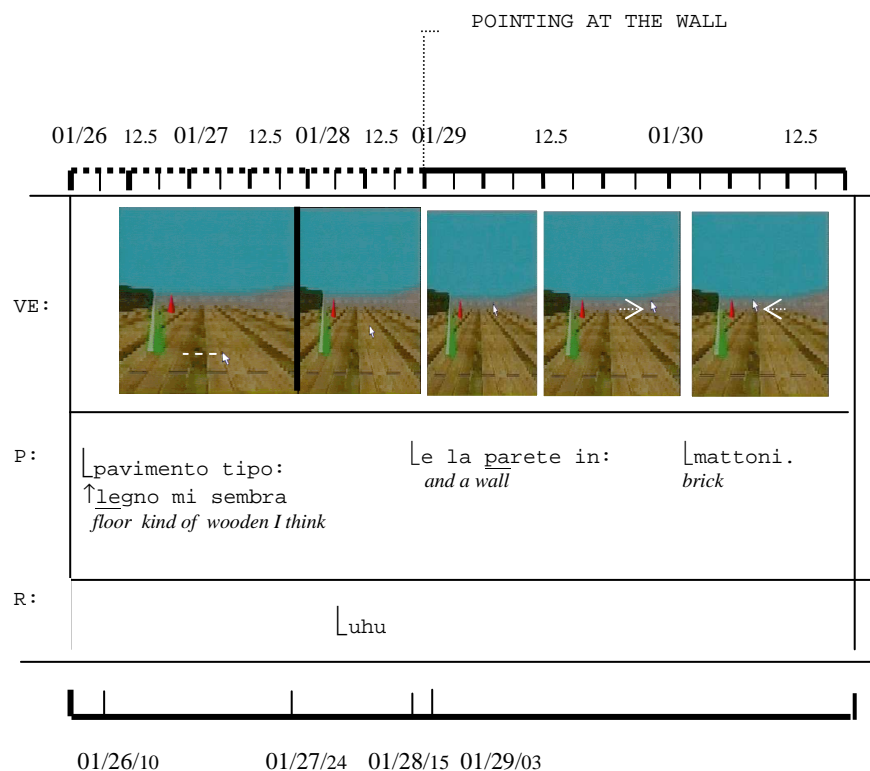


Figure 14. The verbal description waits for the mediated pointing's stroke phase.

In Fragment 3, the arrow moved to the green pyramid when the verbal description had already started; the participant stretched the verbal description by saying “piramide:” (pyramid) until the arrow reached the target; the description then continued with the adjective “verde” (green).

In conclusion, mediated pointing represents a non-verbal resource well synchronized with verbal ones.

### 5.3 Adjustments

Adjustments are likely to occur in mediated pointing for various reasons, including breakdowns of technical infrastructure or user's lack of familiarity with the tool. The adjustments of the arrow's position were part of the stroke phase in Fragment 1, where the verbal description did not wait for their completion in order to be produced. In the episode illustrated in Figure 15, the adjustments are part of the preparation, since they occur when the position of the referent has not been reached yet. The participant is not using a mouse to control the white arrow but a trackball, which is a less familiar tool<sup>4</sup>. The virtual scene is projected on a wall in front of the participant and the researcher, as usual, is next to the participant. The movement of the arrow is segmented and imprecise, as highlighted by the white dotted line in the first frame of the pentagram, and the verbal description is produced when the movement is completed (Figure 15).



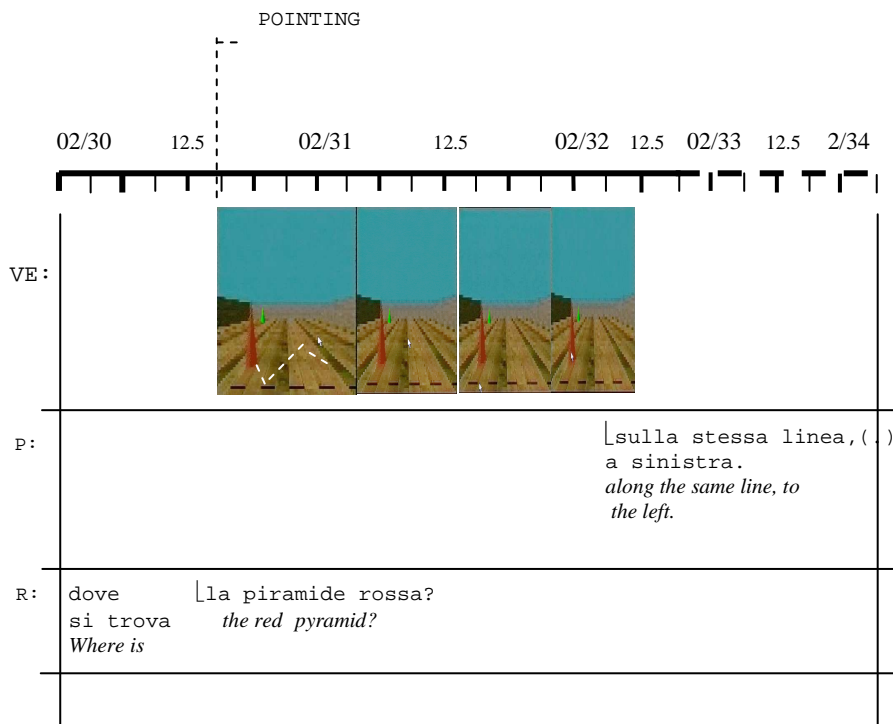


Figure 15. Adjustments in the preparatory phase

Our observations seem to suggest that adjustments are not misplaced but synchronized with the verbal and nonverbal description and that, as in other cases (Spagnolli, and Gamberini, in press), dealing with technical problems becomes part of the mediated action itself.

**CONCLUSIONS**

In the previous paragraphs we have considered various cases of mediated pointing. Supported by the examination of these cases, we illustrated our proposal that the pointing tool works as a prosthesis, extending and modifying the repertoires of possible actions, and expanding the range of reachable objects (Haraway, 1991; Ijsselsteijn, de Kort and Haans, 2005). From this perspective, pointing can be performed with any *bodily-connected device producing an index*, expanding the definition of pointing to legitimately include a mediated one. Mediated and natural pointing become different modalities of the same practice, distinguishable in terms of the spatiotemporal affordances available in the corporeal field. Mediated ‘movements’ can be considered as ‘gestures,’ and in fact operate as a nonverbal resource, in synchrony with other verbal and nonverbal ones. It is difficult to consider natural pointing as the ‘best performing’ pointing modality in all tasks and settings: even projects that have started with the goal of emulating natural pointing, ended up exploiting the peculiar possibilities of pointing in a digital environment, for example the ability to ‘touch’ objects that would not be accessible in a real environment (Hindmarsch, Fraser, Heath, Benford, and Greenhalgh, 1998). Finally, adjustments are a likely component of mediated pointing and are managed

without disruptions in the unfolding of the communicative action, namely without giving up to the synchrony between stroke and verbal reference.

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### APPENDIX

#### Transcription conventions

[	overlap onset
=	latched utterances
(0.5)	pause, represented in tenth of a second
(.)	micropause
:	stretching of the preceding sound
ˆ	rising intonation contour
˙	falling or final intonation
-	cut-off or self-interruption
↑↓	sharp rise/fall in pitch or resetting of the pitch register
(( ))	transcriber's descriptions of events (e.g. cough, telephone rings, ) or non-verbal actions
><	compressed talk (rushed pace)
<>	stretched talk (slowed pace)
(word)	uncertain identification of the word
,	'continuing' intonation
?	rising intonation

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