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Identity, tools and existential spaces

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ABSTRACT

In this article I investigate the emergence of existential spaces during collaborative team work and learning practice. Within Advanced Heart Failure (AdHF) medical training and care I show how participants engage simultaneously in multiple synchronous activities of patient care and teaching and learning and how they make meaning across these spaces about what it means to be/become a learner, and practitioner - developing practice-linked identities (Nasir & Hand, 2008), as *moment-to-moment oscillating synchronous identities*. Building on Heidegger's ontological structures of world and care, I develop an operational definition of existential spaces. In the social context of teaching and learning in practice where asymmetrical power and knowledge distribution situations are in place, it is important to understand how the negotiation of different identities through these spaces can be safely operated to support learners develop practice-linked identities. Through a microethnographic multimodal analysis I make visible at the interactional level the phenomenon of negotiating through these spaces, expanding Heidegger's concept of breakdown to a social activity initiated in order to teach novel form of practice and to support the *Other* to safely develop an identity congruent and integrated with others.

1. Introduction

This article investigates the phenomenon of participation in simultaneous activities of teaching and learning and patient care during collaborative team work practice within Advanced Heart Failure (AdHF). In teaching hospitals, during a medical procedure, participants of the same healthcare team engage in two adjacent and overlapping activities: (1) advanced graduate medical education teaching and learning, and (2) patient care (Koschmann, LeBaron, Goodwin, & Feltovich, 2011). What is the relationship during collaborative team work practice between medical teaching and learning activity on the one hand and patient care on the other hand? Relations of simultaneity of action have been explored on the basis of video-recordings by ethnomethodologically informed studies in multimodal analyses. In her work on the practice activities of surgical procedures, Mondada (2011) shows that rather than considering the surgeon's successive actions as independent concomitant activities of (1) conducting and (2) demonstrating the surgical procedure to an audience of trainees, these activities and their related actions should be studied as one "multiactivity" "constituted by two (or more) parallel streams of action, which on certain occasions intersect and consequently suspend one another" (Mondada, 2011, p. 207). This approach proposes that participants' actions and meaning-making are to be understood in the complexity of multiactivity. In other words, conducting a surgical procedure (activity 1) without having to demonstrate it (activity 2) entails a different sequence of actions than when participants are engaged in both with important implications in Conversation Analysis (CA) studies for identifying the unit of analysis and turn of talk.

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In contexts where learning develops in practice, the process of becoming a professional in a community of practice (Lave & Wenger, 1991) is a relevant part of the practice. If we are interested in considering these practices also from an ontological perspective of becoming a practitioner, the concept of multiactivity benefits from considering a multiactivity not only as streams of action (parallel or intersecting), but as having *different purposes* that can take precedence over the other. In the specific context of this article, I show that graduate medical teaching and learning (concomitant activity1), and patient care (concomitant activity 2) during the invasive procedure of endomyocardial biopsy (heart biopsy) are carried out synchronously and with different purposes that at times intersect and interrupt each other creating the possibilities of *existential spaces* to emerge, each with its own characteristics and yet each influencing the onset of the other. At the interactional level, these existential spaces are defined by how participants express various identities and social positioning (e.g. learner, teacher, healthcare practitioner, patient).

In this paper, I show how these existential spaces can be operationally defined and studied at the interactional level. Recognizing them makes visible how participants negotiate and/or can be supported in negotiating these spaces to develop and sustain what Nasir and Hand (2008) and Van Horne and Bell (2017) call practice-linked identities. These are identities (e.g. science-linked identity; medical practitioner-linked identity) "that people come to take on, construct, and embrace that are linked to participation in particular social and cultural practices" (Nasir and Hand 2008, p. 147).

My analysis raises questions that are important to address in teaching and learning contexts: how can we best relate to and support learners to safely negotiate these existential spaces (e.g. where one is a learner) while developing practice-linked identities? To address this question, I build on Heidegger's concept of *becoming* based on the ontological structure of being-in-the-world and temporal structure of care. Applying them at the interaction level, requires understanding an activity not only as streams of action but as purposive participants' engagement. Only then, it is possible to understand the emergences of different existential spaces. I extend Heidegger's ontological framework which is focused on the individual person developing practice-linked identities (an ontological issue) to a *relational ontological* approach to understand these existential spaces *for the sake of supporting another person* to safely develop such practice-linked identities.

The paper is organized as follows: (Section 2) In the conceptual framework section, I provide (Section 2.1) an account of the ontological issues as addressed in the literature focusing on learning and becoming in practice. (Section 2.2) Based on Hubert Dreyfus' school of interpretation, I discuss the theoretical framing and in particular Heidegger's (1962) ontological structure of being-in-the-world [Weltlichkeit] and temporal structure of care [Sorge], together articulating "being and becoming," necessary to define existential spaces; (Section 2.3) I extend Heidegger's theoretical framework into a relational ontological approach. I call it *relational* ontology because rather than focusing, as traditionally in ontology, on the individual's identity and stance in interaction in a situated activity, I focus on the relational aspect of teaching and patient care and the responsibility of creating a safe space *for another person* to develop practice–linked identities. (Section 3) I describe the study context of AdHF and methods of investigation. The results and discussion of this work are interwoven, as I present the findings in three sets of video-data from four different biopsy procedures (A, B, C and D), each followed by a discussion section: In Section 4, I give an operational definition of existential spaces as emerging in the multiactivity practice. In Section 5, I offer a microgenetic exploration of teaching the *Other* to become in practice, and expand Heidegger's concept of *breakdown* to a social activity initiated in order to teach novel forms of practice and to support the *Other* to safely negotiate through diverse existential spaces; In Section 6, I show that learning to participate in the community's activities changes the ability to move across existential spaces. (Section 7) I conclude with a discussion on the importance of recognizing multiactivity as purposive engagements in existential spaces and of a relational ontological focus to study practices in which it is necessary to support the *Other* safely cross these existential spaces.

2. Conceptual framework

2.1. Identity as a learning process of becoming

Socioculturally oriented research in education has examined ontological issues such as how individuals learn by *becoming* fluent in the cultural practices of communities, whether they be in the workplace, in community groups, or families. This research shows how developing a sense *of the thing to do* by guided participation as understood in sociocultural theories of learning (Gutiérrez & Rogoff, 2003; Rogoff, 2003) or by apprenticeship in the situative theory of learning (Lave & Wenger, 1991) involves the complex process of learning to participate (Gutiérrez, Baquedano-López, & Tejeda, 1999) in the specific activities of the community, the knowledge and know-how of the activities at hand.

In Lave and Wenger's (1991) situated view, the progressive movement from the periphery to full participation, through learning to participate in the specific activities of the community and becoming a full member of a community of practice is governed by the cultural paradigm of a specific community. This presupposes a social structure that predates the activities participants are engaged in and how they are experienced by them (Gherardi & Nicolini, 2002; Schatzki, 1996). However, even if Lave and Wenger have warned us about the danger of considering becoming in practice a deterministic process, by taking recourse to a cultural world as a structure that takes precedence to the activity, participants are assumed to act according to the cultural structure of the community of practice. This approach carries the implicit risk of making the situated view blind to the variety of ways in which practitioners make sense of what it means to be and become part of the community. An understanding of what it means to *become* fluent, to *become* a member of a community, opens possibilities for alternative activities and different way to go about them (Arvaja, 2015; Barton & Tan, 2010; Langer-Osuna, 2015; Levrini, Fantini, Tasquier, Pecori, & Levin, 2015; Nasir & Hand, 2006; Öztok, 2016). As shown by Nasir & Hand (2008) and Van Horne and Bell (2017), a second consequence of predating cultural structure to activities is that the situated view misses the specificity of the use of artifacts in developing practice-linked identities and cannot account for moments of ambiguity and

tension in individual actions and experiences (Gutiérrez, 2002; Gutiérrez et al., 1999; Vågan, 2011).

The work of Holland, Lachicotte, Skinner, and Cain (1998) integrates the diverse theoretical perspectives of Bakhtin and Vigotsky within a larger sociocultural theoretical framework on identity formation. From a Bakhtinian sociolinguistics and literary criticism perspective, Holland and associates can offer a more nuanced perspective where a life story that is told –to others and to oneself– provides a model of developing an identity while responding to multiple and conflicting voices. For example, in their analysis of the story told by an Alcoholics Anonymous member, the multiple and conflicting voices are those speaking to him about drinking as reminders of earlier self, and those voices of other AA members. These contrasting voices will have to be put together to become an AA member through a process of appropriation: the experience becomes one's own "only when the speaker populates it with his own intentions, his own accent, when he appropriates the word, adapting it to his own semantic and expressive intention" (Bakhtin, 1981, pp. 293–294). "In AA meetings participants tell stories about their lives before they joined the organization. They collect tokens for the periods of time they have remained sober. They come to name themselves, and often to see themselves, as "alcoholics" and not just drinkers. All these elements of AA are meaningful in, relevant to, and valued (or not) in relation to a frame of meaning, a virtual world, a world that has been Figured" (Holland et al., 1998, p. 51). In these narratives, knowledge and other artifacts, such as the tokens used to mark length of sobriety, emerge as having mediating roles in learning contexts, practices, and identity formations.

Starting from the person's narratives of events told or recalled, Holland et al. (1998) transform the meaning of *world* understood as a sociocultural historical context we inhabit (e.g. the world of mathematics, academia, medicine etc.) (Heidegger, 1962), into a 'figured world,' a world discussed, talked about and reported by participants in their narratives about their experience of events. The narrators become particular subjects by taking up certain social positions in storytelling with others, how they talk about themselves, objectifying themselves by the qualities of the performance in and commitment to various social positions. Holland and colleagues' work has been successfully utilized to analyze participant interviews about their positioning in the world of the classroom and the world of mathematics (Boaler & Greeno, 2000; Jurow, 2005; Langer-Osuna, 2015) or general medicine (Vågan, 2011). However, being elaborated from a narrative about the world perspective (De Fina & Georgakopoulou, 2015), of an imagined world, this framework is not conducive to studying the relations of identity, artifacts and tools that emerge when participants engage in various courses of action in concert with others in the actual practice where multimodal acts of communication become meaningful for the task at hand (Koschmann, Stahl, & Zemel, 2007; Streeck, 2009).

This gap is addressed by ethnomethodology informed approaches (EM) such as microethnography, multimodal microanalysis and conversation analysis, paying particular attention to the multiactivity various courses of action (Goodwin, 2000; Mondada, 2011) and the meaning making in the *world* (Heidegger, 1962) by formal analysis of actual practice (Goodwin, 1994, 2017; Hall & Stevens, 2015; Streeck & Mehus, 2005). Focusing on the action taken and resources mobilized in interactional situations in order to make sense of what it means to "understand" is common to all methods of talk-in-interaction (Hall & Stevens, 2015; Koschmann & LeBaron, 2002). The intelligibility of spaces, actions and tools is based on viewing participants as engaged in meaning making in spaces of relational organization and co-operation of human action (Goodwin, 2017). Within sequences of talk-in-interaction, Goodwin (1994), for example, demonstrates that what distinguishes one profession from another is a professional vision, the practices used by members of each profession to "hold each other accountable for-and contest-the proper perception" (p. 628).

Through micro-analysis of video- and audio-recordings, EM informed approaches use a method of analysis that reveals the dynamic and unfolding implications of multimodal communication and how communities create competent practitioners so that participants are able to discern the local ecology – a geologist's shared understanding of a section of soil, or an anesthesiologist's tacit ability to read a computer display in order to carry out the task at hand (Goodwin, 1994; Hindmarsh & Pilnick, 2002).

EM informed practices of analysis are partially informed by Heidegger's phenomenology (Stahl, 2012; Streeck, Goodwin, & LeBaron, 2011) and specifically by his theoretical position on what it means to makes sense of things in the world; this includes the resources adopted in concrete interactional situations, such as the manipulation of tools, pointing, gesture etc. The focus of EM informed approaches is therefore the meaning-making that multiple participants manifest while involved in carrying out "courses of action in concert with each other while attending to both the larger activities that their current actions are embedded within, and relevant phenomena in their surround" (Goodwin, 2000, p. 1492). The focus of EM is on the pragmatic, concrete, specific realities of the courses of action of meaning-making in the world.

Developing an understanding of what to do is essential for making sense of a world treating epistemology— the relationship between the knower and knowledge and the intelligibility of pragmatic actions— as discrete, core issues. Yet, the *ontological* dimension of "learning as *becoming*" and "*being a certain kind*" of person or practitioner are left unanalyzed in EM as if it were unproblematic. The consequence of EM taking an epistemological approach is that in multiactivity practices (Mondada, 2011) participants' negotiations of different identities are treated as unproblematic. Instead, by treating epistemological issues as aspects of emergent ontological spaces, as I propose in this paper, the question of how to support learners in the midst of negotiating these existential spaces can be formulated and explored.

2.2. Theoretical framing: Heidegger's fundamental ontology and phenomenology of practice

At the foundation of Heidegger's theoretical work, there is the understanding that the epistemological problem concerning the relation of the knower and the known does not give us the rich and full understanding of the lived experience of making sense of the world we inhabit. To make sense of situated learning, in terms of what it means to participate in the specific activities of a community and to become a practitioner, and how this is connected to making sense of others' actions, spaces, and things as equipment and tools in our world, we need to ask the ontological questions pertaining to *the kind of beings we are* and *are becoming* (Dreyfus, 1991). Within this ontology, the problem of knowledge and skill acquisition is a derivative problem relative to a more fundamental ontological

account (Heidegger, 1962). It moves the focus from the relation knower-knowledge to *learning*, and in doing so, treats it as a complex process of *becoming* a certain person, a certain kind of practitioner (Dall'Alba, 2005; Raia & Deng, 2014).

In particular, Heidegger (1962) conceives *being* and *world* not as inter-defined but unintelligible in isolation. In Heidegger's ontological of being-in-the-world, an object is interpreted as *being* a tool always in the context of the activity in the *world* we inhabit (Koschmann et al., 2011) and is defined: (a) by our use in the activity, (b) by its relation to other tools in attending to the purpose of the activity, and, (c) as recognized in the cultural world (e.g. of academia; community practices) as suitable for the activity at hand (Dreyfus, 1991). Similarly, *being* a professional is defined by our participation mediated by tools and equipment in purposive activities in the *world* we inhabit. This relational whole makes it impossible to make sense of one tool in isolation without the others in the acts of a meaningful activity (see LeBaron, 2002) and marks our participation as co-defined by the use of tools. Participating in a world activity gives meaning to what we are (e.g. a cardiologist). This is consistent with EM approaches and specifically the work of Goodwin (1994, 2017) on developing a professional vision providing a powerful analysis revealing the intricate relation of professional role and equipment at the interactional level of pragmatic action.

However, for Heidegger, the way we confront the existential demands of being *this* (kind of) doctor, "*this*" teacher, in the interactional pragmatic is to be always projected into possibilities of being *this* person, me (Blattner, 2005; Dreyfus, 1991). As Blattner (2005) discusses: "Such projection, moreover, is not a cognitive or intellectual achievement, nor even an imaginative one, but rather a concrete form of conduct. Heidegger characterizes it as "pressing ahead" into the activity of being what one understands oneself to be" (p. 310). This understanding of being that Heidegger calls care has a temporal structure (Blattner, 2005). In the world in which pragmatic actions take place, the present, the here and now of being engaged in activities with others, cannot be studied in isolation because both the past and future projection of *being me* organize how things show up to me in the world as mattering and what it makes sense to do in the present[1] (Raia, 2017). The past is conceived as *being already socialized* into shared accumulated practices. From a Heideggerian ontological perspective, in Lave and Wenger's (1991) model, becoming a professional in a community of practice, changes a person's sensibility to the world. It allows developing attunement of the person to the culture (*world*) of that community which regulates how I feel, how the world opens to me. For the same token, we do not come into a new community of practice as a tabula rasa, we have already been socialized into our lifeworld's shared accumulated practices and sensibilities that organize the solicitations we respond to in the present, as an attunement to the world, as what becomes salient in the present action. As Blattner (2005) discusses: "Dasein's [a person's] originary past is its attunements, the way things already matter to it. I am always already "thrown" into the world and into my life, because I am always attuned to the way it matters to me. These attunements are the "drag" that situates and concretizes the "thrust" of my projection [into possibilities]" (p. 315). Based on this most fundamental temporal structure, the world does not show up only as intelligible, thanks to familiarity with it, but as *mattering* to us. My actions in the activities would make no sense if not being already part of my being in the past and projected into the future of continuing to be me, how I am able to live my life as a teacher in the world I inhabit as a teacher. This also means that our emotional responses and stances (e.g. joy, fear, excitement, high and low spirits, anger, surprise, guilt, pride, helplessness, expectations, hopes) are existentially tied to our structure of being and contradictions in assuming new roles or new identities can emerge (Jurow, 2005; Vågan, 2011). Kris Gutiérrez et al. (Gutiérrez, 2011; Gutiérrez et al., 1999) for example describe the learning space as a third space, emerging from a first space of home, community and peers and a second space of formal understandings associated with disciplines specific or institution. Their analysis shows the learning spaces to be "immanently hybrid, that is, polycontextual, multivoiced, and multiscripted" (1999 p. 288) where conflicts and tensions are intrinsic, creating possibilities of becoming transformative in the actions of resolving them.

Henceforth, what is important to consider is not only the actions and larger activities I engage in, using tools in a specific pragmatic context with others, but the way I do engage in them (Gherardi & Nicolini, 2002; Schatzki, 1996; Wrathall, 2000) because each understanding of being opens different ways in which things matter and in which one can be and act orienting toward others and recognizable ends. The way I engage is the way I understand myself as being me, a certain person, a certain kind of practitioner. I understand the actions embedded in the local activity in the larger contexts as what I am able to be, how I am able to live my life in the world. Through this lens, identity is not understood only as a professional role we play (e.g. *a* teacher, *a* doctor) developed in a sociocultural context. Rather, it is also tied to our historically situated being-in-the-world, projected into possibilities of being and becoming ourselves, and manifests not only in what we can do as membership of a professional practice but also in how we do it, and what is important to us (e.g. to be *this* teacher, *this* doctor, me). It is in this way that we do not arrive at a separation of our emotional responses —a disembodied sense of performing a role in the world.

The implications of foregrounding Heidegger's ontology in teaching and learning has received renewed attention in studies of philosophy of education (Peters, 2002) with implications for higher education systems and educational programs (Barnett, 2000; Bowden & Marton, 2004; Dall'alba, 1998; Dall'Alba & Barnacle, 2007; Dall'Alba & Sandberg, 2006; Thomson, 2001). At the interactional level on which this paper focuses, few scholars have discussed the importance of this theoretical lens (Koschmann, Kuutti, & Hickman, 1998; LeBaron, 2002; Roth, 2009). Building on their work, and specifically the concept of breakdown as discussed by Koschmann et al. (1998), I bring to bear Heidegger's fundamental ontological concepts of structure of being-in-the-world and temporal horizon of care as introduced above that together are necessary to make sense of the emergence of existential spaces in a multiactivity practice.

[1] Past, present, and future as existential provide the primordial horizon for understanding (Blattner, 2005; Dreyfus, 1991).

2.3. Relational ontological focus

As discussed in Sections 2.1 and 2.2, an ontological approach in sociocultural theories to study identity focuses on the individual, how the individual develops or expresses particular identities in inhabiting a world with others. Yet, my interest is in extending the focus on the encountering the *Other* in asymmetrical power and knowledge distribution situations as it is in the case in teacher/student and doctor/patient encounters. Here the professionals have the responsibility to care (Noddings, 1996; Raia, 2017), to take a stand not only on the self but to support the *Other* to safely develop an identity congruent and integrated with others (e.g. being a cardiologist but also a learner developing a new practice-linked identity in AdHF). In multiactivity practice being "this" doctor, being "this" learner, and becoming "this" AdHF practitioner, is enacted in interactions. It needs to be carefully modulated in order to help the *Other* safely move from one existential space (e.g. being "this" learner) to another existential space (being "this" doctor) because as discussed above our emotional responses and stances are existentially tied to our structure of being.

3. The study

3.1. Context

The data I report in this paper are based on a participatory research project studying experiences in the high-tech modern medical practices of an advanced heart failure and transplantation (AdHF) program in a large university hospital (Raia & Deng, 2014). As in other university hospitals in the USA with heart transplantation and long-term mechanical circulatory support (MCS) device programs, the Accreditation Council for Graduate Medical Education (ACGME)-approved AdHF Program trains practitioners in the practice of AdHF after they have completed their internal medicine residency program and the general cardiology fellowship program. The ACGME (2014) defines Residency and Fellowship Programs as '*essential dimensions of the transformation of the medical student to the independent practitioner along the continuum of medical education. They are physically, emotionally, and intellectually demanding, and require longitudinally-concentrated effort on the part of the resident or fellow*.' The AdHF Fellowship is an intensive one-year training program in the care of AdHF patients. AdHF patients are patients who become possible candidates for replacing their malfunctioning heart with another person's heart (heart transplantation) or wearable mechanical circulatory support (MCS) devices (e.g. a total artificial heart that completely replaces a person's heart). Ethnographic work on caring for AdHF patients points to the ideological contradictions emerging from the competing needs to – on one hand - personalize care for the patient as a person and – on the other hand - to objectify bodies and organs (Sharp, 1995). This work demonstrates the struggle of taking care of patients who also are living at the tension between regarding the grafted organ as an intrusion into, an addition to, or a replacement of, the self, and to care for somebody who experiences the struggle (Fox & Swazey, 1974; Haddow, 2005; Lock, 2002; Raia & Deng, 2014; Sharp, 2006). It is in this context that AdHF Fellows learn the technical, relational and communication skills necessary to conduct a humane, safe and successful invasive heart catheter diagnostic procedure, the endomyocardial biopsy (heart biopsy), as part of their future specialized practice. The heart biopsy is performed to monitor rejection of the transplanted heart and follows a specific schedule (protocol biopsy) based on clinical research data of expected likelihood of rejection after heart transplantation, or is done on clinical suspicion of rejection (clinically indicated biopsy). The rejection of the transplanted donor heart by the heart transplant recipient –the patient –is a process whereby the transplant recipient's immune system recognizes the transplanted heart as a foreign body, as potentially dangerous, and tries to destroy it. The histological process of rejection—diagnosed by endomyocardial biopsy—is studied at the tissue level, by routinely taking three to six one-millimeter-size pieces from the transplanted heart of the recipient patient, to analyze for the presence of immune cells. During the heart biopsy procedure, multiple test data such as right heart catheter, heart ultrasound, and electrocardiogram are used to monitor heart function at the organ level, in order to safely conduct the procedure and to also monitor possible dysfunction related to rejection.

3.2. The research model

To study the training practice during the biopsy procedures I designed a research model with three iterative stages:

Stage 1: Video Recording of heart biopsy procedures carried out by a team composed of Attending (AdHF doctor), Fellow (AdHF doctor in training), AdHF Nurse, for patients who have been recently transplanted (1–4 weeks). The Fellows participating are recorded throughout their fellowship training (1 year). Three cameras are positioned to best capture their action and the relative position and movement of instrumentation and participants.
Stage 2: Co-generative dialoguing (cogen) (Elden & Levin, 1991; Roth & Tobin, 2004) sessions (video/audio taped). Participating AdHF Attending/Fellow/Nurse from the medical team whose interactions were recorded in Stage 1 are invited to participate in weekly two-hour-long audio/video-recording viewing sessions to make sense of their taped practices and discuss the emerging elements and themes. As indicated by ACGME, the fellowship training is physically, emotionally, and intellectually demanding and, based on this, the Fellows are not expected to participate in more than 6 cogen sessions during the year. These sessions are analyzed for relevant themes. Jointly reviewing the data in cogen sessions allows for a rich perspective on the practice, to address issues and pose questions that are most relevant to practitioners and checking for validity of the emerging patterns identified in this study.
Stage 3: Video analysis of biopsy-recordings (Stage 1) and cogen sessions (Stage 2) to identify the multimodal resources (Goodwin, 2000) utilized by participants to organize their conduct and reciprocal accountability. Events that are recognized as important in

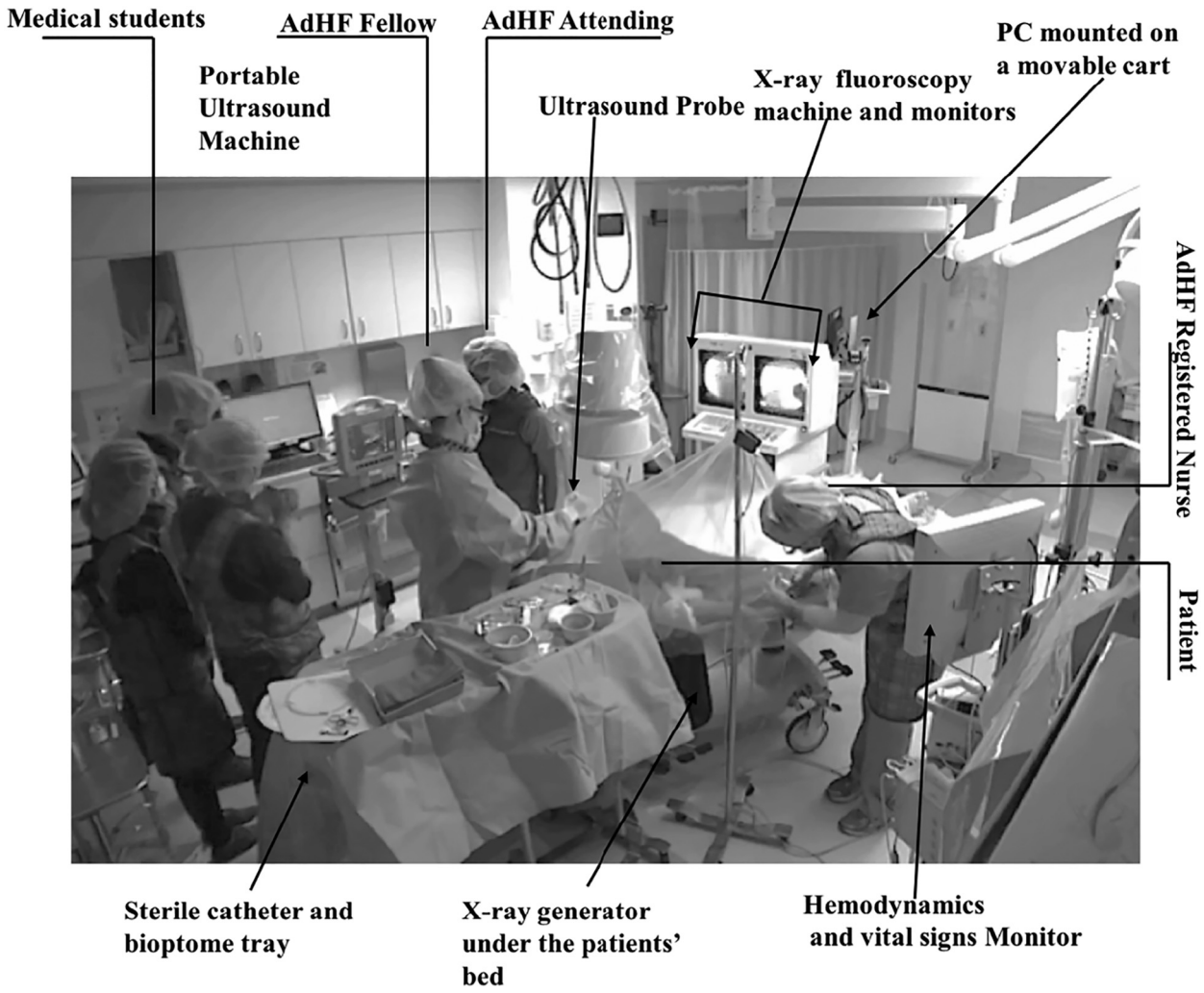

Fig. 1. The endomyocardial biopsy suite during a procedure.

the emergence of themes ranging from 30 s to 5 min are transcribed (Sacks, Schegloff, & Jefferson, 1974) and microanalyses of gestures, body movements, and prosody (Goodwin, 2000) of the events are conducted. A phenomenologically (Heidegger, 1962) informed audiovisual method is used to make sense of the AdHF practice.

Segments are then presented to the participant healthcare professionals and in the weekly data analysis interdisciplinary meetings of education researchers, linguistic anthropologists, ethnomethodologists, and science studies researchers.

3.3. The heart biopsy

The procedure room shown in Fig. 1 is a carefully designed space for the organization of the biopsy activity, where (1) computer-assisted equipment – (a) ultrasound probe and monitor screen, (b) X-ray fluoroscopy machine and monitor, (c) desktop mounted on rolling cart and (d) hemodynamics and vital signs machine and monitor– mediates the meaning of the actions, and (2) participants orient to the relevance of what shows up on the screens and information is taken up from these computer-mediated resources and is reformulated to others and into actions.

The biopsy procedure follows a specific protocol and the data reported here are from the beginning stage of four different biopsy procedures. At the beginning stage of the procedure the AdHF Attending and the AdHF Fellow need to use ultrasound guidance to locate an anatomical landmark to gain access to the jugular vein through which they will then insert needles, wires, sheaths and bioptomes to reach the heart. Difficulties can arise, for example, from the presence of clots or scar tissue in the skin or in the vein wall of the patient after repeated biopsies. Mistakes in identifying the right access can result in increased risk for one of the complications of the heart biopsy —an accidental puncture of the carotid artery. This artery runs directly adjacent to the jugular vein and carries blood with high pressure, so, if punctured, a fast flow of blood can rush into the surrounding tissue with subsequent large hematoma

formation. These difficulties may lead to prolonged times at the start of the procedure and are associated with varying degrees of pain and/or discomfort for the patient.

While the doctors explore the possibility of access to the jugular vein, the patient lies awake on the catheter table and under an impermeable sterile tent with his/her head turned away from the doctors in order to allow access to the jugular vein. Patients are usually very apprehensive during the procedure for many reasons: fear of pain and complications, fear of serious difficulties in carrying out the procedure that could prevent biopsying the heart for rejection analysis and fear for the possibility that the results of the biopsy indicate rejection of the grafted heart.

4. Operational definition of existential spaces

The data presented in this section are from two procedures –biopsy A and biopsy B. I chose these two biopsies because both procedures took place during the same day and with the same Attending and Fellow at the beginning of the training year. The excerpts from both biopsies A and B are from the same protocol stage of the biopsy. This choice allows focusing on how the complex multiactivity practice (Mondada, 2011) of patient care and of educating AdHF Fellows can emerge in very distinctive ways and how to understand them as existential spaces. Each biopsy procedure is presented in segments. Each segment is described in terms of the actions taken by the participants. I use Heidegger's ontological structure of being-in-the-world described in Section 2.2 to identify the tools used as interconnected to participants' practice-linked identities and in doing so offer an operational definition of the existential spaces.

Biopsy A – Background. Waiting for the Attending, the Fellow using the ultrasound probe finds that there is a serious problem in accessing the Patient's vein caused by the presence of a clot. He waits outside the biopsy suite to meet the Attending and reports his concerns to avoid worrying the patient that the procedure may not be possible because of this access problem. It is a serious issue for this Patient. It is the second attempt after transplantation and the doctors are worried that without access to the heart they will not have enough information to rule out rejection. Medically, this is particularly worrisome because early after transplantation there is high chance of mortality due to rejection.

Fig. 2 shows the Fellow using the ultrasound probe (in his left hand) on the patient neck pointing to the monitor for the Attending to see the clot (2a).

The Fellow is holding the ultrasound probe in his left hand in both Fig. 2a and b. Attending and the Fellow both orient to the relevance of what shows up on the ultrasound screen. The Fellow orients the probe in order to explore and show on the ultrasound screen the presence, the location and extent of the obstacle in the vein. Then he looks at the Attending (Fig. 2b). The relevance of what shows up on the screen is reformulated: by the Fellow who shifts his gaze from the monitor to the Attending (Fig. 2b) as interrogating for shared understanding and, for the Attending who does not move his gaze from the screen, and moves his hand to take the probe. His hand movement to grab the probe continues in Fig. 3a. The Fellow steps back and the Attending moves forward to operate the probe on the Patient's neck (Fig. 3b). The Fellow keeps his gaze on the screen as does the Attending. When the Fellow turns toward the Attending to comment on the narrowing of the vein (Fig. 3c) as they are seeing it on the screen, the Attending responds to the Fellow's concerns, but keeps his gaze on the screen. As they also reported in cogen session (research model–stage 2), Attending and Fellow are worried about the prospect of not finding access and being unable to do a biopsy of the heart to test for rejection for this Patient. The sequence shown in Figs. 2 and 3 lasts for approximately 5 min and 30 s. As shown by the waveform at the bottom of Fig. 3, very few words are exchanged and are inaudible to all in the room but them, most of the communication is done in multimodal manner by gaze, pointing to the monitor or gesturing for example to get the probe. Then, when the Attending resolves to abort the procedure finding no possibility to access the vein and gives back the probe to the Fellow (Fig. 3d), the two doctors start discussing the issue of how to proceed. Their voices are barely audible to avoid worrying the patient about their assessment that the procedure may not be possible because of this access problem.

As discussed in Section 2.2, to make sense of the kind of beings we are, and more specifically the role we are taking up and how these are entwined with the intelligibility of our activities and ourselves within the world we inhabit, Heidegger relates all equipment to each other in a relational whole that he calls “significance”. In this phenomenological view of biopsy A, both Fellow and Attending do not encounter “mere things.” Rather they use the ultrasound probe with the ultrasound monitor and other equipment *in order to* participate in actions embedded in the activity of the biopsy procedure in the context of AdHF care (*world*). Each activity has a goal for each action (*in order to*) and an end for the activity (*toward–which*). As shown in Table 1, Fellow and Attending use the ultrasound probe *in order to* identify the relative positions of vein and artery on the ultrasound screen. The ultrasound probe is moved and oriented on the Patient's neck *in order to* show the relevant image on the screen, *in order to* gain access to the vein *toward the end of* making sure the carotid is not punctured and the local anesthesia can be administered to the neck of the Patient.

The *purpose of* the larger activity is to conduct the biopsy procedure and test for heart rejection (purpose of the activity). In this structure, equipment is defined with its use with other tools in the context of the activity in the world of AdHF the participants inhabit. The ultrasound probe is intelligible as such by its function (‘probing’) at a specific time during the activity (in order to finding access to the vein). It is connected to other tools such as the ultrasound screen, the needle, the catheter table etc. All the tools together are used with each other with their accepted function and in the proper order that allows the procedure in the specific context of AdHF care to be done. They are organized in a referential whole: referring to and bearing upon one another they give meaning to the other tools' role in attending to the specific goal of action and purpose of the activity - the probe is meaningless without the ultrasound screen, the gel used on the patient neck, the bed on which the patient lies and used at the proper time in the accepted sequence of the biopsy procedure. What it means to be an ultrasound probe is given by its significance in relation to other tools and by the purposeful use by the participants engaged in the specific purposeful activity. By using the probe in the larger context activity of

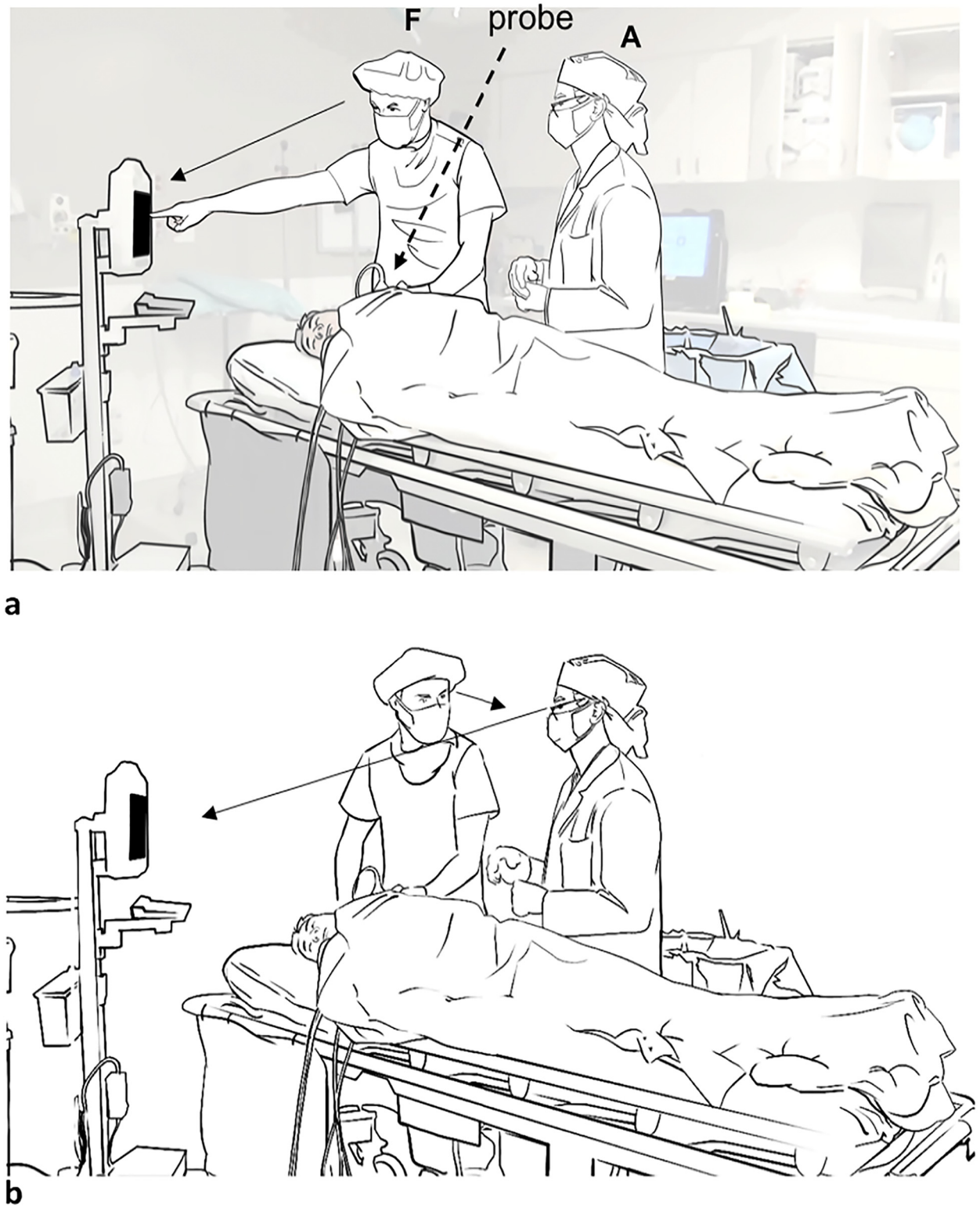

Fig. 2. Fellow (F) and Attending (A) operating the ultrasound to assess entrance.

the biopsy procedure, the doctors give meaning to the probe.

The second move I see in Heidegger's ontological construct of the structure of being-in-the-world is to inter-define the referential whole in the context of the larger activities with the larger purpose of the activity we engage in as the fundamental ground of being

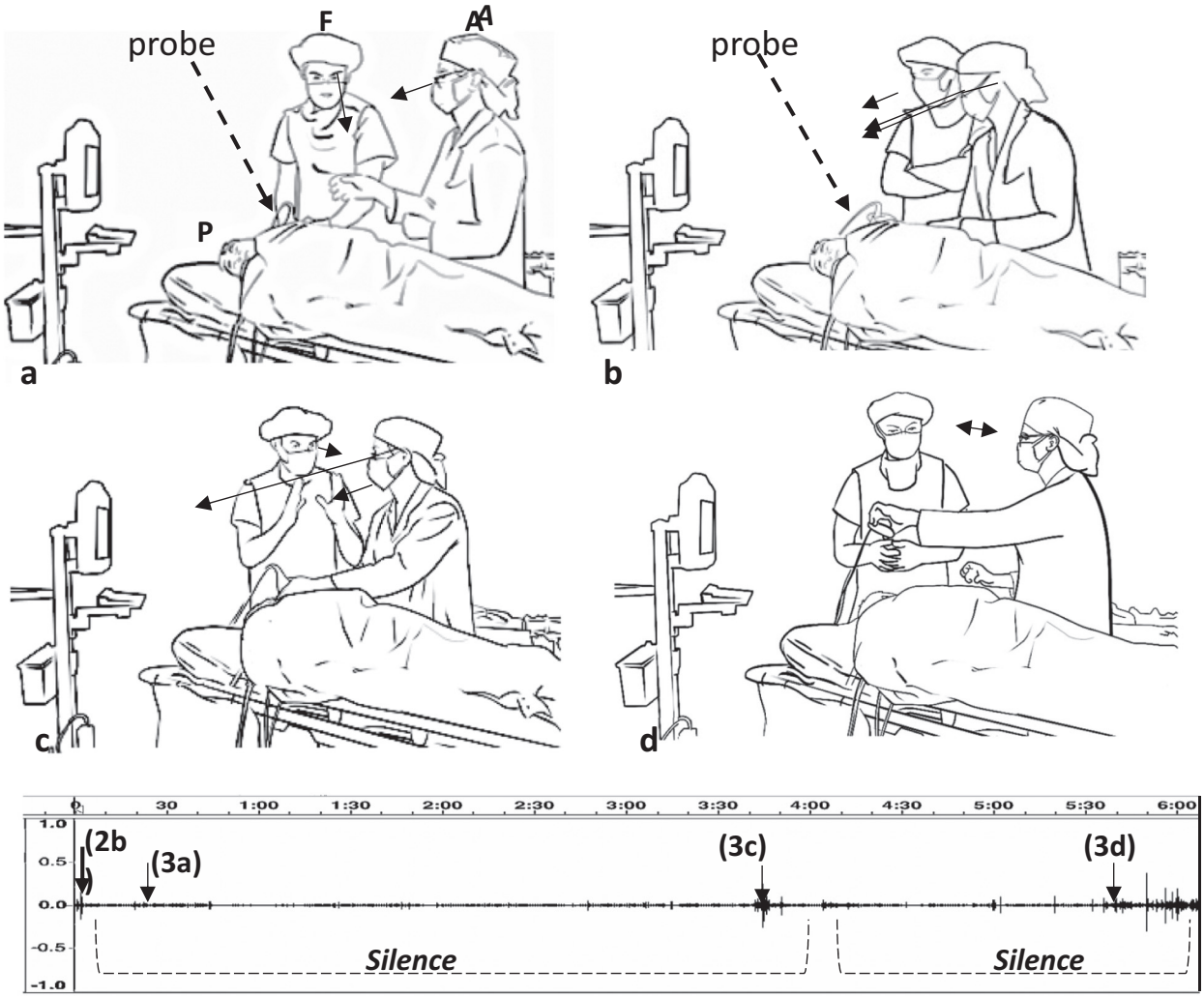

Fig. 3. AdHF Attending (A), the AdHF Fellow (F) and Patient (P) at the beginning of the procedure. Black arrows highlight A′ and F′ gazes. Annotated waveforms (bottom) for biopsy A shows graphically the time of talk and the time of beginning of the events discussed. Numbers in parentheses refer to figures number.

Table 1
Tools, activities and existential spaces at the interactional level (from Figs. 2 and 3).

	Existential patient care space		
	Attending	Fellow	Patient
Use tool	Ultrasound probe to map the landmark area	Ultrasound probe to map the landmark area	Keep the head's position still
Goal	To gain access to the vein	To gain access to the vein	To allow docs to gain access
Purpose	Conduct a safe and effective biopsy to test for rejection	Conduct a safe and effective biopsy to test for rejection	Receive a biopsy to rule out rejection
Existential space	Being AdHF doctor	Becoming a AdHF doctor	Being/becoming a AdHF Patient

who we are. The use of things as equipment such as the ultrasound probe is done so by the doctor not only for the goals of the action (*in-order-to*) and purpose of the activity with others, but also for the sake of *being* a doctor. As Dreyfus (1991) discusses: "Heidegger uses the term "for-the-sake-of" to call attention to the way human activity makes long-term sense, thus avoiding any intimation of a final goal. A for-the-sake-of being a father or being a professor is not to be thought of as a goal I have in mind and can achieve. Indeed, it is not a goal at all, but rather a self-interpretation that informs and orders all my activities" (p. 95).

While the *significance* of a tool emerges by us using it in the world of AdHF cardiology in its referential whole, that is, with other tools and in the context of the activity, we cannot make sense of who we are without the use of tools in their referential whole and

```
01    A:    ya what exactly
02    A: what I find important is that uh
03          just uhm uh uh  guide your own way
04          for example I like to uh you know
05          for example now
06          I know if I move with my left hand
07           to this direction
08    F:    um hmm
09    A:    and then uh
----
12          and so you have the vein on top
13          and I compress the vein
14    F:    yaah
15    A:    gets compressed
16          and the carotid is right
17    F:    here
18    A:    below
19    F:    mmhmm
20    A:    and doesn't get compressed
21          and so th::en
22          I just do the first angulation
23          I uh angulate the uhm
24          ultrasound like 45 degree distally
25          to just see how it continues there
26          and then I turn in a uhm WHI::ile
27          maintaining the focus on the vein?
28          look at the monitor?
29    F:    uh hmm
30    A:    maintain the focus on the vein
31          and uh turn it to longitudinal
32          so now I know I'm on the vein
33          now I go distAl?
35          on the vein
36          I'm just following the vein
37          to see if there is anything
38          more distally
39          what's the confluence
40          That uh suggests any stenosis
41          I don't see anything
42    F:    hmm mm you mean proximal
43    A:    no, distally. I mean,
44    F:    yah ehh
45    A:    towards the heart
```

Fig. 4. Teaching AdHF Attending (A) shows the AdHF Fellow (F) how to recognize and follow the vein path with ultrasound.

being with others. The Attending cannot be a AdHF cardiologist by sitting in his armchair at home and never come to the hospital, never use the biopsy suite, never use an ultrasound probe, never meet and work with colleagues and patients and simply state "I am an AdHF cardiologist".

To summarize, we cannot understand an activity as simple streams of action, as a sequence of *in-order-to* without goals. We need to understand it also as purposive participants' engagement. It is in engaging in a purposeful activity that we define what is a tool (an ultrasound probe is used to scan the neck) and at the same time this tool in its relational whole with other tools in practical context of

Table 2
Existential spaces. An example of Heidegger's World Structure using one of the tools engaged in the activities in Figs. 2, 3 and 4. Note that there is no Patient participation indicated in the teaching/learning existential space. The reason for this choice is also clarified by the example reported Fig. 4.

	Existential teaching/learning space			Existential patient care space		
	Attending	Fellow	Patient	Attending	Fellow	Patient
Use tool	Monitoring position of ultrasound probe in Fellow's hand	Positioning ultrasound probe respect to the Patient neck		Ultrasound probe to map the landmark area	Ultrasound probe to map the landmark area	Keep the head's position still
Goal	Help to correctly position of ultrasound probe for access	Attempt to position ultrasound probe to gain access		To gain access to the vein	To gain access to the vein	To allow docs to gain access
Purpose	Teach ultrasound mapping	Learn ultrasound mapping		Conduct a safe and effective biopsy to test for rejection	Conduct a safe and effective biopsy to test for rejection	Receive a biopsy to rule out rejection
Existential space	Being a teacher	Being a learner		Being AdHF doctor	Becoming a AdHF doctor	Being/becoming a AdHF Patient

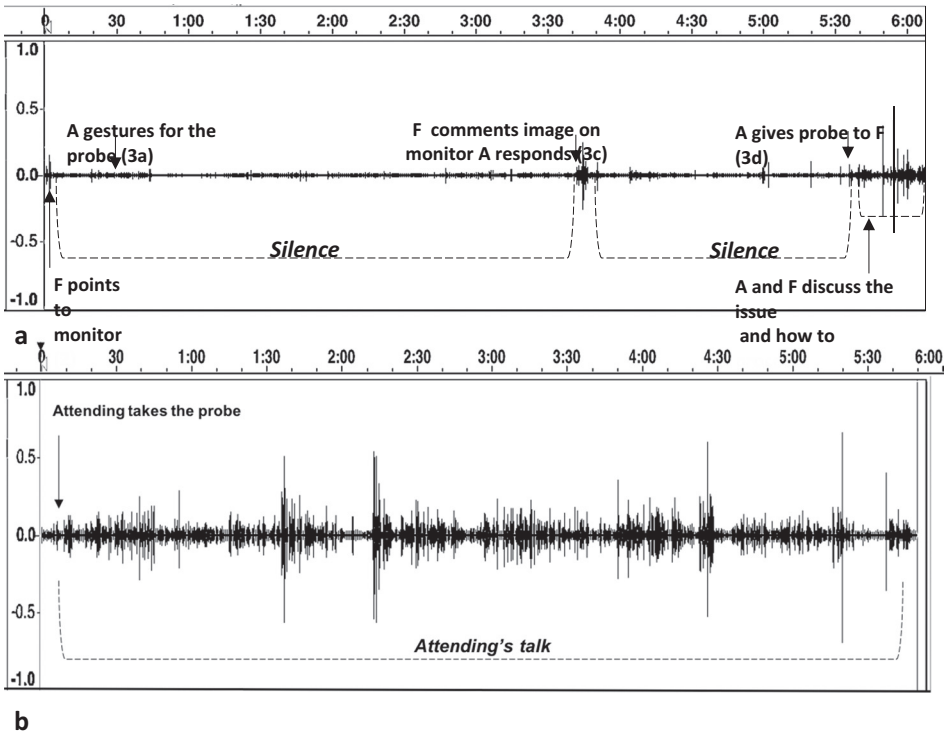

Fig. 5. Annotated waveforms for biopsy A (top) and B (bottom) showing graphically the time of talk during the procedure and the time of beginning of the events discussed. Numbers in parentheses refer to figures number.

its use gives meaning to who we are. This understanding obliterates the separation of *world* and *self*: one does not make sense without the other. Self and world are not only inter-defined but unintelligible in isolation. The activity shown in Figs. 2 and 3 is summarized in Table 1 which defines, at the interactional level, an existential space for being/becoming a doctor for the Attending and Fellow and being/becoming a AdHF Patient for the person lying on the catheter table.

Biopsy B – Background. Carried out the same day as biopsy A, biopsy B is performed by the same Fellow and Attending but on a different Patient. This time, the situation seems to present no particular initial impediment to a successful completion of the procedure. Using the ultrasound probe, the Fellow has just finished showing his initial assessment of the possible position of the access to the jugular vein. Based on this brief, the Attending has assessed that the Fellow has not fully mapped the area or understood three-dimensionally the relative position of jugular vein and carotid artery and asks for the probe to show the Fellow how to map the area.

In the sequence shown in Fig. 4, the Attending is teaching the Fellow how to map the entire area. Pointing to the ultrasound screen (Fig. 4a and b), the Attending holds the probe in his left hand at a specific inclination and position on the patient's neck, *in order to* show how to identify the relative position of the vein and artery and the inclination of the probe on the patient's neck. The Fellow looks from the screen (Fig. 4a) to the probe (Fig. 4b) *in order to* check how its inclination is rendered on the screen. The Fellow, from Fig. 4b to c moves his arm from his bust *in order to* point to the screen acknowledging to the Attending his understanding of what the Attending is teaching (Fig. 4c) and points (Fig. 4d) in the direction of the probe's inclination.

The sequences of the streams of action in biopsy A (Figs. 2 and 3) and biopsy B (Fig. 4) segments are different, they are organized by different goals (*in-order-to*), and different activity's purposes. The goals and purpose of the activity constrain the solicitation and affordance the participants respond to. Contrary to biopsy A, the Fellow moves his gaze back and forth between the ultrasound screen and probe because he is solicited by the need to learn how to orient the probe on the patient neck to map the area on the screen. The differences define different meanings for the tool as a resource and a different existential space. In Fig. 4, in relation to the rest of the tools, the probe is used –moved on the surface of the patient's neck, angulated in different ways– to teach the Fellow how to create a complete map of the area. It is a tool for teaching and its use defines the role of the participants –teacher for the Attending and learner for the Fellow.

4.1. Discussion. Existential spaces of teaching and learning and patient care

In Table 2, the existential space of teaching (biopsy B) is compared with the existential space of patient care described in biopsy A.

These are spaces defined by the meaning and use of tools and the point of the activity and their constraint in defining the participant's role/identity and defines what is relevant and what to respond to for the participants. Importantly, in the excerpts from biopsy B (Fig. 4), the Patient's body is acted upon not for the sake of making sense of this specific Patient's anatomy to care for him but

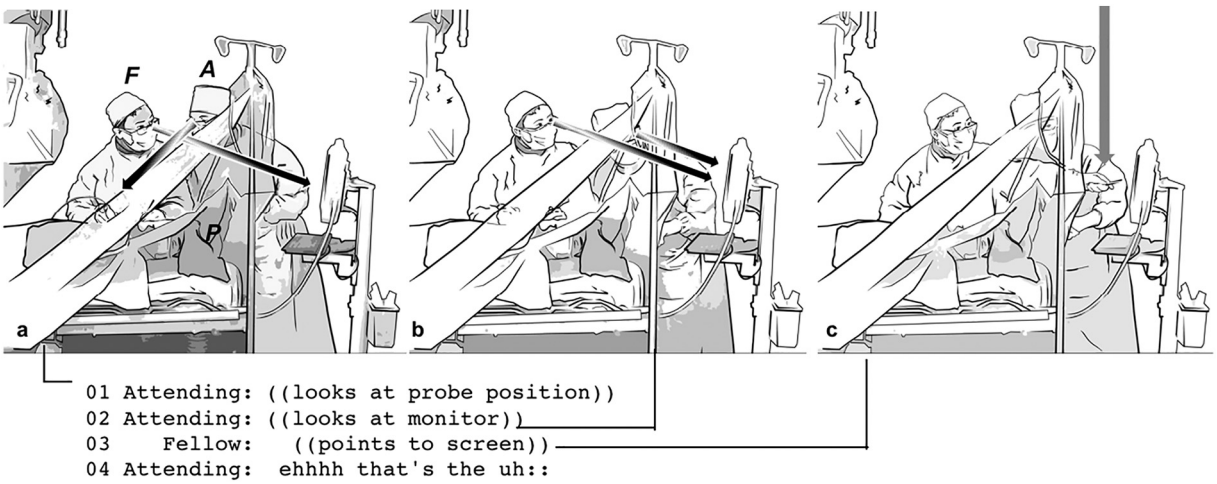

Fig. 6. Biopsy C. AdHF Attending (A), the AdHF Fellow (F) and Patient (P) at the beginning of the procedure. Larger arrows highlight A′ and F′ gazes (a) and (b). Note the Attending checking the position of the Fellow's hand (arrows indicating gaze direction), then what is showing up on the screen and what the Fellow is looking at and interpreting. The gray vertical arrows points to the position of the Fellow's hand (c).

as generic platform to show how to map an anatomical area with an ultrasound probe. Similarly, Koschmann et al. (2011) show how that the surgical field is utilized as resource for an impromptu lesson in anatomy (p. 528) during a surgical procedure where concomitant activities of teaching and patient care are carried out during a surgical procedure.

There is no participation of the Patient *as a person* in the teaching and learning space. The Attending and Fellow do not lower their voices to protect the Patient from hearing as it happens in biopsy A. This is a space that is created and practiced by the healthcare professionals for teaching and learning and any intervention of the Patient would be considered an interruption of the on-going pragmatic activity.[2]

Fig. 5 shows the comparison of the annotated waveforms for both existential spaces described.

The two activities Fig. 5a and b differ also by the time of talk. In Fig. 5a, Biopsy A is characterized by very little talk, and actions to arrive at a consensus diagnosis and to solve an issue for this particular Patient's anatomic configuration. In contrast, as shown in Fig. 5b, the Attending's time of talk is almost continuous for 6 min. The wording differs as well, for example the Fellow is a learner who is learning 'something more in general' (line 07), i.e. the mapping of the area, not solving a specific problem with a colleague as it was in Biopsy A. The two activities with different use of tools and their meaning mediating actions and, different purposes define ontologically different existential spaces defining different identities AdHF doctors and Patient in biopsy A and Attending-Teachers and Fellow-Learner in biopsy B.

5. Negotiating diverse identities through existential spaces

In the previous section, the two excerpts from biopsy A and B show that the different activities with different purposes, actions' goals and different use of tools point to different existential spaces (Table 2). However, as Mondada (2011) points out, the sequence of action necessary to carry out each activity can intersect and suspend one another as shown in the following excerpts.

Biopsy C – The third biopsy procedure takes place one month in the training year with the same Attending but different Fellow. The Fellow has assessed the feasibility of the procedure and already prepared the Patient for the procedure by covering him with sheets under a sterile tent and is now awaiting the arrival of the Attending.

In Fig. 6, the AdHF Attending and the AdHF Fellow are collaboratively engaged in using ultrasound guidance to locate an anatomical landmark to gain access to the jugular vein through which they will insert needles, wires, sheath and bioptome to reach the heart. The Fellow holds the probe in his right hand and a pen in his left to make a mark for the area of access on the Patient's neck.

The Attending is visibly looking (Fig. 6a, line 01) at the position of the probe in the right hand of the Fellow (its angle of inclination and position on the patient's neck) and (Fig. 6b, line 02) at its projected image rendered on a two dimensional ultrasound screen. The Fellow is very intent into trying to gain access to the vein, and keeps his gaze continually at the images rendered on the ultrasound screen. As both Attending and Fellow orient to the relevance of what shows up on the ultrasound screen, the Fellow reformulates it into the action of pointing (line 03) to the relative positions of the artery and vein.

In supervising the Fellow and checking his holding of the probe (Fig. 6a) and the images on the screen (Fig. 6b), the Attending notices that the Fellow needs to better map the area. He *asks* to show the Fellow how to do it (line 05, Fig. 7a) *before* the Fellow makes

[2] Here, consistent with the Cartesian dualism that characterizes the biomedical paradigm (Scheper-Hughes & Lock, 1987) and ethnographic studies showing the competing need for healthcare professionals to, on the one hand, care for the person and, on the other hand, to objectify bodies and organs (Sharp, 1995, 2006), from the perspective of the doctors, the Patient is not participating in the activity. His body is facilitating the learning of Fellows for the sake of the future care of other patients.

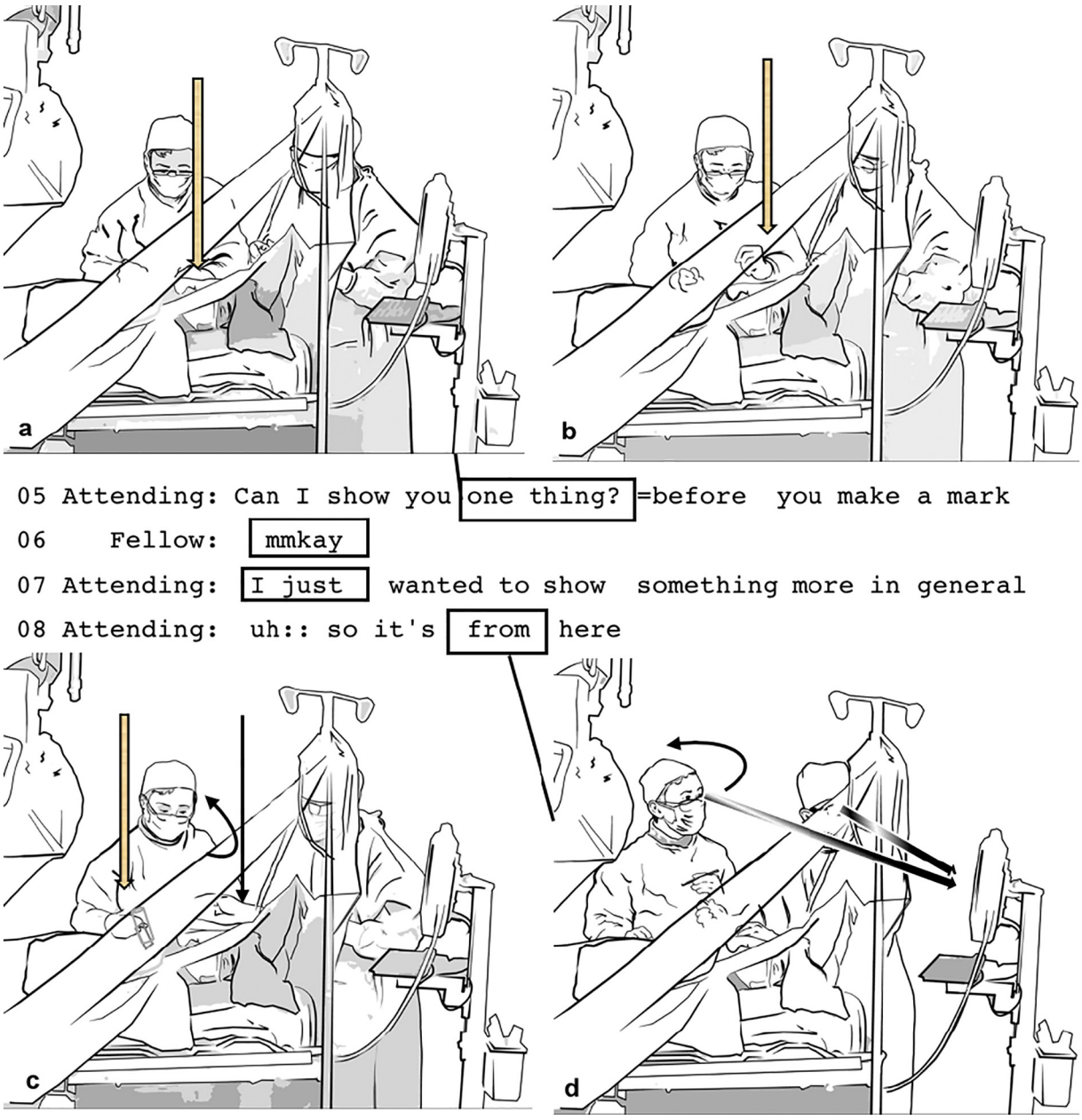

Fig. 7. Biopsy C. Thicker vertical arrows points to the position of the Fellow's hand. The thinner black vertical arrow (c) points to the position of the Attending's hand (c). The Fellow body's movements described in the text are indicated here by curved arrows.

a mark on the neck of the patient.

This call from the Attending demarcates for the Fellow a passage from one existential space where he is the doctor conducting a biopsy procedure to care for this Patient into another existential space where the Fellow is a learner who will now learn 'something more in general' (line 07), i.e. the mapping of the area. In Figs. 6 and 7, we have two activities, the biopsy procedure (for patient care) and the teaching and learning (for training in practice) and the passage from one existential space where the Fellow is a novice AdHF doctor taking care of the Patient to another where the Fellow is taught in a graduate medical education program to become an Attending AdHF cardiologist.

A similar passage is shown in the excerpts from biopsy B in Fig. 8. These excerpts show the activity just preceding the excerpts shown in Fig. 4 discussed in Section 4 as an example of activity in the existential space of teaching and learning. In Fig. 8, the Fellow is showing his initial assessment of the possible position of the jugular vein. The Attending (Fig. 8a) moves to take the probe with his right hand because he has noted that the marking of the area done by the Fellow is not complete. The Attending announcing his move with 'let me'(Fig. 8d line 16), extends his right arm again to grab the probe, calling the Fellow out of the patient care existential space

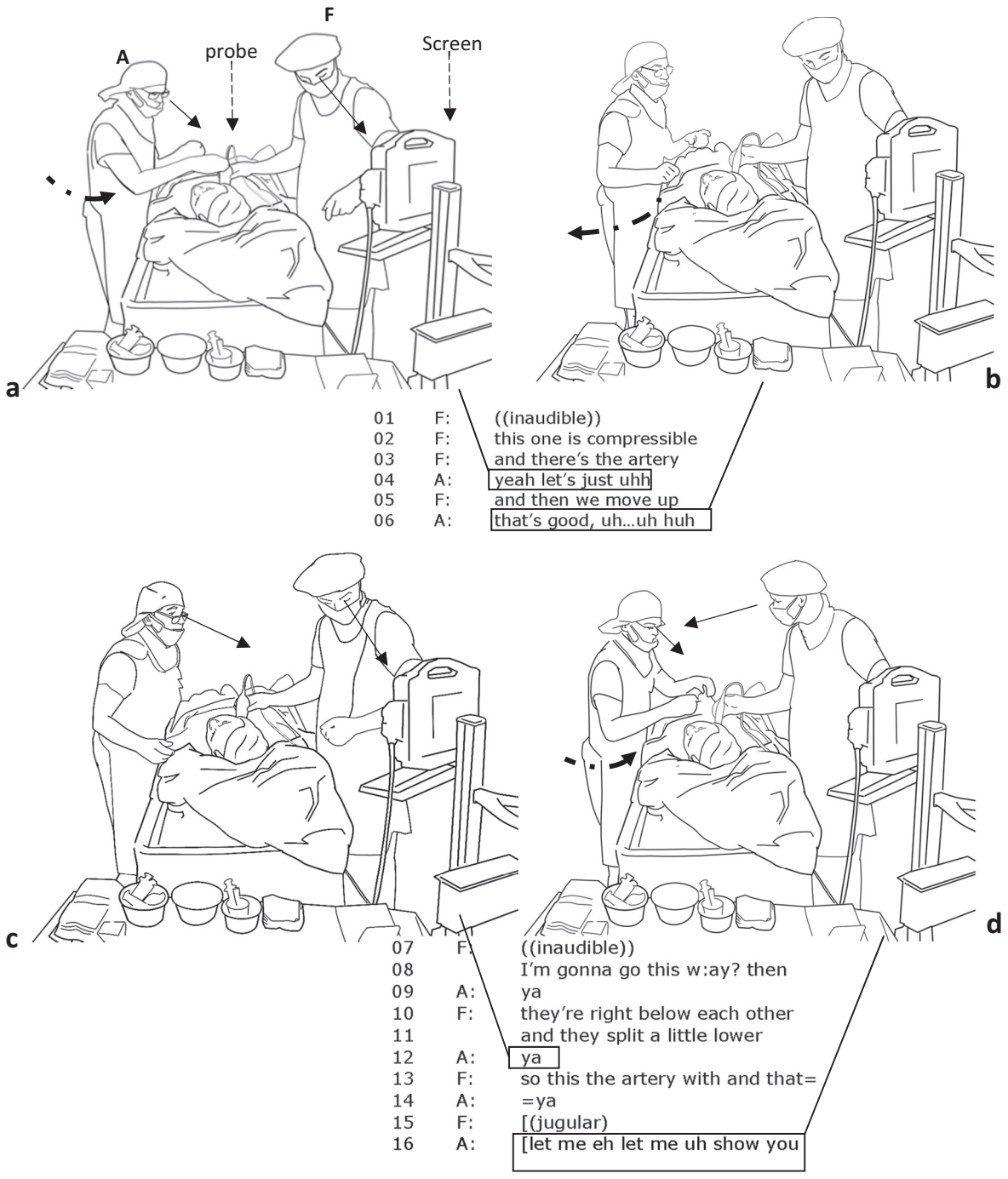

Fig. 8. Biopsy B. AdHF Attending (A), the AdHF Fellow (F) and Patient (P) just before the teaching activity shown in Fig. 4. Straight arrows indicate Attending's and sand Fellow's gazes, curved thicker arrows indicate the Attending's right arm movements. (a) The Attending initiate the movement of his right arm to take the probe from the Fellow and utters line 04, (b) he repairs his movement by retracting the arm and verbally affirming what the Fellow is showing –line06. (c) The Attending intensively listening to the Fellow, (gazing at the monitor with the Fellow and uttering brief verbal affirmations line 9,12,14) until the Fellow looks at the Attending (d).

into the teaching and learning existential space.

5.1. Crossing existential spaces is a breakdown of fluid pragmatic action

If we understand an activity as an ontological space, these transitions then are obligating the participants to arrest the ongoing

activity to start another activity with a different purpose, action goals and practice-linked identities. Defining existential spaces requires to extend Heidegger's concept of *breakdown* from an interruption of fluent purposive pragmatic actions into *the transition from one existential space to another*, a social activity initiated in order to teach novel forms of practice.

Simply put, Heidegger's disarmingly simple but powerful concept of breakdown is the interruption of fluent, non-reflective doing. In holding the probe unreflectively, that is without being aware of how the probe lies in his hand covered by a glove or its weight, the doctor simply uses the probe focusing on finding access to the vein. If the probe is malfunctioning, the doctor concentrates on trying to find out what is wrong with it, or find another one. This is a situation of breakdown because now the doctor is not simply using the probe to find access to perform a biopsy procedure. He concentrates on the probe itself and the pragmatic activity of probing is interrupted. Koschmann et al. (1998) compare the concept of breakdown of fluent pragmatic doing with that of Leont'ev and of Dewey. In doing so they establish a relation of the concept of breakdown as detached thinking, deliberating and reasoning to teaching and learning in problematic situations. Specifically, they consider the know-how as "acquired through successive experiences of trying, failing, and eventually acquiring the skills (and knowledge) we need to function competently in the world." (p. 40). They posit that a breakdown of familiarity with one's own world is necessary to learn.

In the data presented here the breakdown of the ongoing fluent pragmatic action of tracing the vein's path to find access is interrupted by the call of the Attending (Biopsy C, Fig. 7a line 05; Biopsy B, Fig. 8). It is this breakdown that allows the Attending to move the Fellow from one existential space to another, from being transparently involved in taking care of the patient —not concentrating on the probe, but on the patient in need of having his new heart biopsied– to being a learner, and concentrate on the various position and inclination a probe can take on the neck of the patient and how this is rendered on the ultrasound screen. This breakdown, interruption of fluid action and passage from one existential space to another is initiated and conducted by the Attending.

5.2. The transition of existential spaces treated as a relational ontological issue

In the context of teaching and learning in practice, the transitions then become a *relational ontological* issue, because it reveals how the passages from one existential space to another are negotiated in a relational context. Specifically, in the AdHF medical training context, there is an uneven distribution of power and knowledge as the Attending teaches, supervises and evaluates the Fellow and the Attending facilitates, conducts and controls the passages from one existential space to another. As discussed in Section 2.2, being a doctor or a student involves not simply roles played while engaged in a stream of actions, but identities always projected into a future of being and becoming, modulating what is important to us and our emotional responses. In the example of biopsy C (Figs. 6 and 7), the transition is from being a doctor preparing for biopsying to being a learner, learning how to use the probe to map a patient's anatomical structure. In Fig. 7, the Attending needs to take the probe from the Fellow's right hand, and needs to move partly into the physical space occupied by the Fellow to show him how to use the probe for a complete mapping of the area. What is particularly interesting here is that after asking "can I show you something?" (Fig. 7, line 05), the Attending does not move until the Fellow has agreed and moves backward (Fig. 7, line 06) and slightly to the left (line 07) to make space for the Attending (line 08). The Attending's right hand enters the working space (line 07) only once the Fellow has allowed space for it, giving the probe he holds in his right hand to the Attending and removing the left hand that is holding the marker from the Patient's neck. Finally, the Attending (line 08) holds the probe in his right hand and shows how to map the area more systematically and in general - that is, not specifically to solve the problem of access in this specific Patient's case. Both Attending and Fellow are now engaged in looking at the monitor in a teaching and learning space.

In biopsy B, Fig. 8, the Attending, after noticing that the marking of the area done by the Fellow is not complete, initiates the move to take the probe with his right hand (Fig. 8a). However, the Fellow is intently looking at the screen and continues his demonstration, pointing (Fig. 8b) with his left hand on a specific location on the screen while holding the probe in his right hand. The Attending withdraws his hand and listens to the Fellow's description. When the Fellow is done, he looks at Attending and only then, announcing his move with "let me", the Attending extends his right arm again to grab the probe, calling the Fellow out of the patient care existential space into the teaching and learning existential space.

In Fig. 8, the Attending amends his gesture of grabbing the probes –or borrowing a term from conversation analysis (CA)–

Table 3
Temporal horizon for the structure of care.
An example of application of Heidegger's temporal structure of care using the excerpts reported in Figs. 7 and 8. Note that past and future are existential concepts providing an existential horizon for understanding the present for the Attending (self), in the activity (world) and, in a relational ontological perspective of helping the Other.

	Existential past	Existential present	Existential future
Self	It matter to me how I interrupt the action	Being what I am doing: a certain kind teacher	Possibilities of being this person (me)
World	Attunement: sensing the action as an interrupting the Fellow's fluid action of being a doctor	Meaning in action (e.g. repair, or wait for the right moment to call)	What makes sense to do: wait for right moment for the interruption
Relational ontological approach	Noticing salient moments of transition for the Other	Creating a safe space for the Other to transition from one to another existential space	Project the Other into possibilities of being and enable the Other to safely cross existential spaces

"repairs" his action and withdraws the hand. A self-repair is understood in CA as providing a window into the speaker's concerns for something that cannot be properly said in conversation, for example overstepping the limits of propriety (Hayashi, Raymond, & Sidnell, 2013; Schegloff, Jefferson, & Sacks, 1977). A self-repair provides a window into the speaker's concern for an utterance that in the case of Fig. 8b is the Attending's gesture. This is important because the Attending, by repairing his gesture, removing his hand from grabbing the probe, is showing his concern for the moment of moving the Fellow from one existential space to another. The Attending repairs his own action and waits for the moment to make the passage possible without interrupting the Fellows with an abrupt move from one existential space to another. The call to cross the spaces is done when the Fellow has finished his assessment and looks at the Attending for confirmation. At this point, the Attending moves his hand again and requests the probe (Fig. 8d, line 16) "let me". These excerpts also give us a window into not only what makes sense to do for the Attending, but also *how* to do it. As summarized in Table 3, the repair shows concern for the action to be repaired. It matters to the Attending how to teach and help the Fellow develop his practice-linked identity as a AdHF cardiologist.

As discussed in Section 2.2, Heidegger argues that in the world in which pragmatic actions take place (the present, the here and now of being engaged in activities), both (a) the past –being already socialized into shared accumulated practices – modulating our sensibility and attuning to what is important to us and, (b) the future conceived as being always pressing into possibilities of being me, organize how things show up to me in the world as mattering and what it makes sense to do in the present. The actions in the activity would make no sense if not being already part of the Attending's being attuned to what he cares for and projected into the future of continuing to be himself, how the Attending is able to live his life as a teacher, a doctor in the world he inhabits as a teacher, or as a doctor. Through this lens, being a AdHF doctor is not understood only as a role developed in a sociocultural context, but also tied to the person historically situated being-in-the-world projected into possibilities of being and becoming this person, this kind of practitioner, and manifests in what it makes sense to do (how the Attending does it, what is important to him and what solicitation he is responding to). As a teacher, the Attending's actions speaks toward a sense of responsibility to guide the Fellow across the spaces and to make sure that passage is not abruptly imposed to allow a safe development of the Fellow's identity of becoming a AdHF doctor, and safe space to learn to become.[3] As such the passages from one existential space to another where these different identities are manifested are conducted very carefully to support the *Other* to safely develop an identity congruent and integrated with others.

6. Tools and existential spaces and their negotiation in skillful practice

The use of tools, paraphernalia and equipment also manifests the Attending's different level of involvement in the activity depending on Fellow's level of skillful practice. At the beginning of the training, the initial assessment for the feasibility of the biopsy is done by the Fellow supervised and taught by the Attending (Biopsy A and B, Figs. 2, 3, 4, 8). During the training, the Fellows acquire experience in recognizing the anatomical feasibility for the procedure to take place through the use of ultrasound probe and its two-dimensional rendering on the ultrasound screen. They make decisions to proceed by preparing the patient, organizing all the paraphernalia necessary for the procedure to take place (sterile tent, cloths to protect the face of the patient under the tent as seen in Biopsy C, Figs. 6 and 7). Stevens and Hall (1998), have described this performative learning emerging at the interactional level as "discipline perception" a set of community specific forms of embodied action, entailing not only 'how members of a professional community see and the implication they draw from what they see but also in a valuation or what they treat as properly visible and invisible' (p. 109). In Biopsy C, the Fellow has made the assessment that the biopsy is feasible based on what is visible on the ultrasound screen and, showing his assessment to the Attending, is ready to proceed making a mark in order to set the access point. However, what is visible to the Attending, is not yet visible to the Fellow who is developing "discipline perception". Both Attending and Fellow are 'scrubbed in'—hands and forearms thoroughly washed and disinfected and wearing sterile attire (coats).

In Biopsy D (Fig. 9), the same Attending is working with a Fellow at the end of her training in AdHF. Note here that the Attending has his hands disinfected but is not *in* sterile attire. This means that he can neither touch any tool on the sterile table (needles, bioptome. probe) nor the patient's neck area exposed for biopsy. The use of the sterile coat by the Attending is dependent on the Attending's understanding of the Fellow's level of skillful practice, the discipline perception and also defines the teaching style and level of mastery and comfort (Dreyfus & Dreyfus, 1988) in supervision. If a challenging situation arises, the Attending will have to understand it early enough and request the nurse to help him immediately scrub in to avoid adverse effect on the quality of patient care. Later in the fellowship training, unless a biopsy procedure is very complex requiring both the Attending and the Fellow to perform it together as is the case of gaining access through the femoral vein rather than the jugular vein, the Fellow's level of independence and skillfulness in conducting the procedure is recognized by both Attending and Nurse and phenomenologically manifests, at the beginning of the procedure, by the Attending not requesting to be helped by the Nurse in scrubbing in or the Nurse not offering to help the Attending to scrub in. This applies also to the level of experience of the Attending. As shown in Fig. 10, a professionally less experienced (Dreyfus & Dreyfus, 1988) Attending scrubs in immediately after entering the biopsy procedure room as her/his "discipline perception" is developing with experience, both as a teacher and as a doctor. In a situative approach it can be seen as the progressive movement from the periphery to full participation (Lave & Wenger, 1991), through learning to participate in the specific activities of the community. In the context of team work and instruction, the use of paraphernalia and their meaning is part of participants' tacit knowledge that allows them to move, respond, react in a familiar situation.

Biopsy D – Background. The Fellow has identified the access point and has proceeded into the next step of administering the local anesthetic into the patient vein area. Then some difficulties arise when she tries to access the vein with the finder needle to be able to

[3] These are advanced graduate education medical programs and the have been working with patients since at least seven years.

01 A: more medial
02 toward lateral
03 F: yeah
04 there is medial
05 A: move it more ((points))
06 A: the particular vein
07 F: yeah, like this?
08 A: Yeah
09 even more medial
((points to the probe))
10 you just=
11 F: =more medial?
11 A: Yeah
13 A: right now you have
14 the carotid
15 F: yes
16 A: and the vein
((points to screen))
17 F: yes
18 A: in other words
19 if you angulate this
20 forty-five degrees ((mimic movement))
21 from medial
22 to lateral
23 F: ((moves probe toward lateral))
24 A: like this
25 exactly like this
26 F: ((maintains the probe in position))
38 P: you're really breathing hard
39 N: ((looks at Patient))

42 N: oh sorry hih hih
41 F: is he okay there?
44 N: he said i was breathing
hard[00:22:19.17]
45 F: ok(h)ay(h) hih
((turning back to Attending))

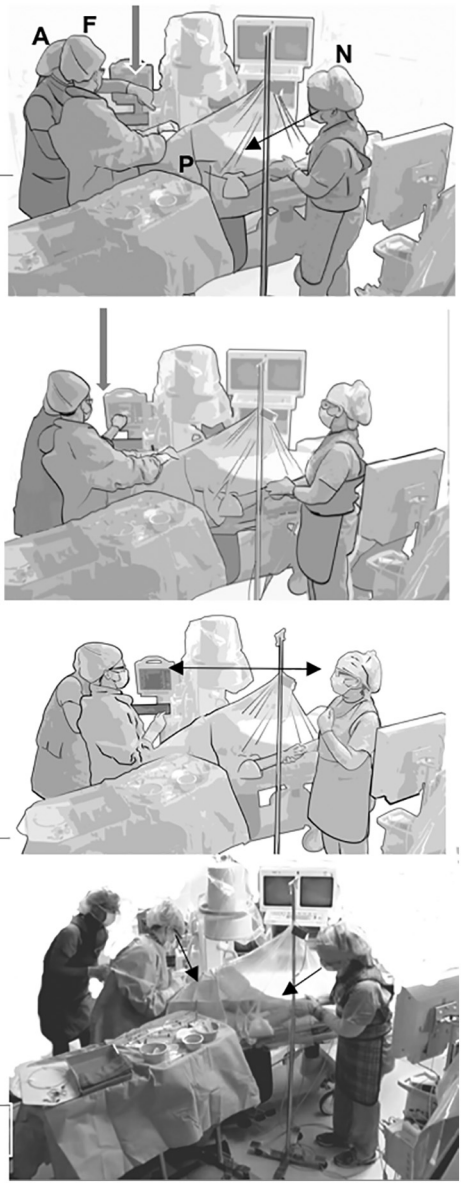

Fig. 9. The Fellow (F) Attending (A), Nurse (N) and Patient (P). F is holding the probe on her right hand and looks at the Attending's hand (a) to the monitor (b). Vertical thick arrows points to the Attending's hand. (a, b). Black arrows show F's and N's gazes Fellow's gazes.

insert other tools to keep the vein stable while entering it with the bioptome for the biopsy proper. However, the patient's veins are very small, becoming very collapsible, and their paths more difficult to define. The Fellow will need to use the ultrasound probe and screen again This is an unexpected difficulty in the specific situation for this Patient's anatomy and physiology that she has not encountered before. These difficulties are recognized by the Attending, who is not scrubbed in, in the expectation that the Fellow can, under supervision, overcome the possible difficulties. In fact, the Attending is teaching the Fellow on how to use the ultrasound mapping technique in the specificity of this patient's anatomical configuration, guiding and advising how to move the probe, without the necessity to take it in his hand, without having to scrub-in.

Here the multiactivity space is more intricate as, for example, the Attending not been scrubbed in, is demonstrating high confidence in the Fellow's ability as a doctor, and at the same time an understanding of her level of competence as a student that allows her to learn for this complex case mapping with ultrasound without the Attending needing to show how and in need therefore to be sterile and scrubbing in.

The Patient is lying awake on the catheter table with his body covered by a sterile tent. The Nurse is on his right and the Attending and Fellow on his left, trying to enter his neck vein. The tent is pulled up on the nurse's side to let fresh air in and allow some visibility of the room to the Patient. The Patients is facing the Nurse's side exposing his neck on the other. The Nurse caring for the Patient,

Fig. 10. A junior Attending and a senior Attending wearing different attires while supervising a Fellow at the end of training. In (a) the junior Attending is fully scrubbed in and in sterile cloths. He stands at the head of the catheter table (right) watching the Fellow preforming the procedure. In b) the senior Attending is not in sterile cloth but only wearing the lead apron for protection against X-ray. He stands on the other side of the catheter table (right) to hold the patient's hand while watching the Fellow preforming the procedure across from him.

lowers her head in order for the patient to see her face and takes his hand, patting it (Fig. 9a). The Attending and Fellow are engaged in teaching and learning practice with ultrasound probe and screen. On line 1–5, the Attending asked the Fellow to change the inclination of the probe (line 1–2). The Fellows checks her understanding (line 3–4), and the Attending corrects it (line 5). They apply the mapping technique to differentiate the carotid artery and jugular vein respective paths (to line 26). The Attending's gaze moves from the screen to the hand of the Fellow to check the probe position and inclination. The Attending's and Fellow's voices are hearable, even if, at times, the exact wording are muffled by the masks and not understandable. At line 27, the Patient utters a sentence hearable for everybody in the room. It is the Nurse that responds to him maintaining the dyad with the Patient while the Fellow is engaged in learning the techniques to solve the access problem. As indicated in Table 1, the Patient does not participate in the teaching/learning space by addressing the doctors directly when engaged in their teaching and learning activity, but does address the Nurse who is taking care of his wellbeing (line 38).

6.1. Discussion

Hindmarsh and Pilnick's (2002) study on the interactional team effort and the subtle, intersubjective dynamics of conducting medical anesthesiology work, shows the tacit knowledge and practices that enable the healthcare professionals to coordinate their actions to administer anesthesiology prior to a surgical procedure. Their study focuses primarily on the healthcare professional team. In Biopsy D, we see a tacit practice that also enables the Patient specific acts of participation recognized by the other healthcare professionals as valid. These are practices that are, as Wenger has it, "all the implicit relations, tacit conventions, subtle cues, untold rules of thumb, recognizable intuitions, specific perceptions, well-tuned sensitivities, embodied understandings, underlying assumptions and shared world views […] [are] unmistakable signs of membership in communities of practice" (Wenger, 1998, p. 47).

The Fellow, at line 41, interrupts her teaching and learning activity with the Attending to ask the Nurse if the Patients is "ok", passing from one activity to another herself. She does not address the Patient directly in caring for him, because her activities with the Attending are not completed, but she maintains control of the passage from the different activities and existential spaces. This is understood by the other team members: The Attending waits for the Fellow to check with the Nurse and resumes his teaching as soon as the Fellow turns back to him. The Nurse reports on the Patient while maintaining the dyad with the Patient in order for the Fellow to go back working with the Attending. The Patient does not address the Fellow directly as also seen in all the examples of teaching and learning activities.

For the Fellow, learning to participate in the community's activities, changing discipline perception with experience, also modify the ability to control the movement across existential spaces, in this last case smoothly operated by the Fellow.

7. Conclusion

In this article, I have discussed the issues of studying multiactivity practices common in teaching hospitals where participants of

the same healthcare team engage in two adjacent and overlapping activities during a medical procedure: (1) advanced graduate medical education teaching and learning, and (2) patient care (Koschmann et al., 2011). I started by addressing the question of what an ontological approach can reveal about the participation in these activities and the shifting engagement from one activity to another. Building on Heidegger's *ontological structures of being-in-the-world* and *care*, I showed that an ontological perspective to study multiactivity is productive to make sense of these activities as *existential spaces* in which the process of *becoming in practice* unfolds. In taking this approach and making the ontological perspective of becoming a practitioner relevant to my investigation, I expanded the concept of multiactivity from a concept being studied as parallel and intersecting streams of action as done in CA (Mondada, 2011), to being studied as purposive participants' engagement in existential spaces, allowing to studying the process of *becoming* in a community of practice where members concurrently participate in multiple activities. I developed an *operational definition of existential spaces* in which practice-linked identities manifest in the specificity of the activity at hand in order to be able to identify and study them at the micro-interactional level. As numerous scholars have shown that a *sense of being* relates to motivation, involvement, (e.g., Cobb, Gresalfi, & Hodge, 2009; Gee, 2000; Nasir & Hand, 2008; Sfard & Prusak, 2005), learning (e.g. Arvaja, 2015; Fields & Enyedy, 2013; Langer-Osuna, 2015) and as a process of transformation and appropriation of discipline discourse (e.g. Gutiérrez et al., 1999; Gutiérrez, 2011; Levrini et al., 2015) the operational definition of existential spaces is particularly productive in education research focused on the interactional level because it opens the possibility of studying not only their emergence but also inquiring about the meaning of continually having to cross these existential spaces in multiactivity practice. For example, in the implementation of project-based curricula, students are engaged with opportunities to work on contextualized problems and providing a connections between what is learned in the classroom and the world of practice outside it, and issues of shifting engagement between engagement across classroom practice as a classroom *world* (Holland et al., 1998) and activities representing the different practice *world* often emerge (Jurow, 2005). In these social contexts, focusing on the phenomenon of negotiating through these existential spaces at the interactional level, I showed that extending Heidegger's concept of *breakdown* to a social activity initiated in order to teach novel forms of practice, helps understand the negotiation of the diverse identities in and through these existential spaces (from being a student to being a doctor) as an interruption of the unreflective skillful fluid mode of being. In social interaction contexts where asymmetrical power and knowledge distribution are always in place such as in teacher/students and doctor/patient encounters, the passages from one existential space to another regulate the tone and the quality of teaching and learning and care for the Other because the existential demand of being a learner, being and becoming a certain kind practitioner encompasses affective, emotional, cultural, and social aspects. In classroom contexts, for example, Greiffenhagen (2012) analyses the work of a teacher's interventions during ‘rounds’ among groups of students working on a collaborative-learning activity that spans over several lessons and shows that while not in the form of antagonistic struggles, tensions between teachers and students do still emerge. These tensions can be understood as the manifestation of a disruption of the smooth flow of engagement in the activity, the passage from one existential space (working group ‘researcher’) to another (working group ‘student’) imposed by the teacher. I posited that to best support this passage we need to address it as a question of *relational* ontological nature because rather than considering the ontological question of the individual development of practice-linked identities, it focuses on the relational aspect of teaching and the responsibility of creating a safe space for *the Other* to develop practice –linked identities. In the work presented here, a relational ontological focus safeguards the passages from one existential space to another in order to support the collaborative aspects of medical teaching and learning and patient care to prevent a separation of our emotional responses, a disembodied sense of performing a role, and to foster the notion that our meaning making and actions constitute our body, our practice and our identity in the world.

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