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2012

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In E. Salas, S. Fiore & M. Letsky (Eds.), *Theories of team cognition: Cross-disciplinary perspectives* (pp. 405-420). New York: Routledge.

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### Recommended Citation

Koschmann, Timothy, "Team Cognition and the Accountabilities of the Tool Pass" (2012). *Book Chapters*. Paper 6.  
[http://opensiuc.lib.siu.edu/meded\\_books/6](http://opensiuc.lib.siu.edu/meded_books/6)

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**Team Cognition and  
the Accountabilities of the Tool Pass**

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Salas, E., Fiore, S., & Letsky, M. (Eds.). *Theories of Team Cognition: Cross-Disciplinary Perspectives*.

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## **1. Toward a 'Science of Teams'**

The title of the book, "Theories of Team Cognition: Cross-Disciplinary Perspectives", hints at a broader agenda, one both rich with promise and fraught with potential troubles. Teamwork lies at the nexus of a variety of disciplines interests. Cognitive and social psychology, organization science, human factors research, communication studies, to name a few, all have scholarly interests related to the functioning of groups and teams. Given this convergence of interest, it would seem mutually advantageous to find ways of sharing insights across fields. The current volume seeks to engender just such a conversation. It endeavors to do so by trying to articulate the assumptions and "theoretical drivers" that motivate and undergird research within these disciplines. It represents a first step toward advancing this kind of conversation within an area of study that already has an overabundance of ways of formulating its topic, e.g. "distributed cognition" (Hutchins, 2006), "group cognition" (Stahl, 2006), "macrocognition" (Cacciabue & Hollnagel, 1995; Klein et al., 2003; Letsky & Warner, 2008), "socially-shared cognition" (Resnick, Levine, & Teasley, 1991; Cannon-Bowers & Salas, 2001), "team learning" (Senge, 1990), not to mention, "team cognition" (Salas & Fiore, 2004). By creating a taxonomy of theoretical models and seeking to identify areas of overlap between them, it is hoped that progress can be made toward integrating basic findings related to the performance of teams.

In this way, the book addresses a larger agenda, one intended to eventually lead to a 'science of teams', a science that would eventually enable us to make positive recommendations regarding how teams should function. This would require establishing an agreed upon theoretical vocabulary and set of measurement methods. Taken for granted within this larger enterprise is a shared allegiance to a way of conducting

research that entails: [1] formulating an abstract model of what counts as the phenomenon of interest, [2] constructing operational means of measurement, and [3] using these measures to test hypotheses about how the matter, so construed, might be done better. The disciplines currently participating in the conversation on teamwork (i.e., cognitive and social psychology, management science, communication studies) all have a strong psychological orientation. However, as we expand the circle of participation wider and reach out to other disciplines, some problems begin to emerge. It becomes apparent that this strategy of beginning from a base of theoretical constructions is not one that is universally embraced across the human sciences. Indeed, some social scientists reject this kind of approach categorically and on principle. We will examine one critique of formal theorizing in the social sciences and point out its relevance to the task of constructing a science of teams. We offer a sample of an alternative form of analysis and suggest a framework for what might be termed a ‘hybrid’ approach to studying teams.

## **2. Garfinkel’s Critique of the Parsonian Theory of Action**

As a discipline, sociology is centrally concerned with explicating the basis of society and social structure. It addresses the classical Hobbesian question of how it happens that our interaction with others is, for the most part, orderly. A historically important position on this question was that developed by Talcott Parsons. The state of the discipline in the early part of the 20th century, as Parsons described it, resembled the contemporary literature on teamwork. He (1937) reported “there are as many systems of sociological theory as there are sociologists” and lamented “there is no common basis” (p. 774). Parsons sought to rectify this. His ambition was to not only to develop a unifying theoretical base for sociology, but one that would serve for all the “sciences of action” (p. 769)—economics, political science, psychology. In a volume that profoundly shaped

sociological inquiry for half a century, Parsons (1937) surveyed the writings of four prominent social theorists of the previous century and proposed a unified framework for studying social action.<sup>1</sup> His approach was based on the study of “the elementary unit act” (p. 768). By his account, this unit act could be analyzed in terms of four more fundamental components:

(1) [The act] implies an agent, *an actor*. (2) For purposes of definition, the act must have *an end*, a future state of affairs toward which the process of action is oriented. (3) It must be initiated in *a situation* or which the trends of development differ in one or more important respects from the state of affairs to which the action is oriented, the end. The situation is in turn analyzable into two elements: those over which the actor has no control, that is which he cannot alter, or prevent from being altered, in conformity with his end, and those over which he has such control. The former may be termed *the conditions* of action, the latter *the means*. Finally, (4) there is inherent in the conception of this unit, in its analytical uses, a certain mode of relationship between these elements. That is, in the choice of alternatives, there is a “normative orientation” of action. Within the area of control of the actor, the means employed cannot, in general, be conceived either as chosen at random or as dependent exclusively on the conditions of action, but must in some sense be subject to the influence of *an independent, determinate selective factor*, a knowledge of which is necessary to the understanding of the concrete course of action. (pp. 44-45, emphasis added)

Parsons believed a science of human action could be constructed on the basis of an analysis of this sort.

By including subjective elements such as perceived “ends”, “normative orientations” and choice amongst alternatives, he sought to incorporate the perspective of the actor into his model. It was to be a model whereby action was not strictly determined by environmental conditions but reflected some form of choice on the part of the actor. Thus, Parsons entitled his approach “the voluntaristic theory of action” (p. 62). The actor’s choices in this model, however, are guided by socially-accepted norms of conduct. Parsons defined an *end* as, “a future state of affairs to which action is oriented by virtue of the fact that it is deemed desirable by the actor(s)” (p. 75). A *norm*, therefore, “is a verbal description of the concrete course of action thus regarded as

desirable, combined with an injunction to make certain future actions conform to this course” (p. 75). Action, from the observer’s perspective, is made meaningful in the light of such norms, though Parsons’ model does not require that the agent necessarily be mindful of these socially-prescribed norms when acting. Parsons endeavored to construct a means of studying action, one that could still meet the standards of an empirical science and provide a basis for prediction. His approach was thoroughgoing and elegant. As an effort to unify existing social theory, it was a tour de force.

Harold Garfinkel, one of Parsons’ students, had certain reservations with regard to the program put forth by his mentor. The Parsonian ‘theory of action’, in Garfinkel’s view, was curiously detached from the practicalities of what people actually do. Garfinkel (1952) charged that the Parsonian actor inhabits “a world-by-definition” and explained:

This world is populated *not with persons but with puppets*. These puppets are creatures of [the theorist’s] own design: ideal types. (p. 58, author’s emphasis)

Garfinkel protested, however, that actors are not “judgmental dopes” (p. 259)—they are not simply following rules or complying with normative standards. The model advanced by Parsons, he argued, fails to engage the forms of practical reasoning actually employed by actors within their social arrangements. Social order, for Garfinkel, is an actors’ achievement and something that needs to be investigated within their vernacular world. He argued that any situation can “be viewed as self-organizing with respect to the intelligible character of its own appearances as either representations of or as evidences-of-a-social-order” (Garfinkel, 1967, p. 33). In place of Parsons’ hypothesized action frame, we find a proposal to instead look at how members themselves actually produce their social settings as understandable. “The argument that meaning requires order, and the empirical elaboration of how this is achieved through sequential devices

and reflexive attention, are Garfinkel's unique contribution to social theory" (Rawls, 2008, p. 703).

Garfinkel overturned Parsons' program of system building and replaced it with an empirical one devoted to describing the processes through which actors themselves construct meaningful worlds. He directs our attention to how actors produce their actions as sensible and competent. "The design of social actions so that others can make sense of them is an indispensable feature of social action, for unless it is possible for people to recognize 'ordinary social facts', they would not be capable of mutually adjusting their conduct with respect to one another in commonplace settings" (Button & Sharrock, 1998, p. 75). These kinds of design and recognition, it might be noted, are also prerequisites to any form of teamwork. Garfinkel made several additional observations pertaining to the self-organizing character of social activity.

Social settings are organized in very particular ways. Garfinkel noted, "Any setting organizes its activities to make its properties as an organized environment of practical activities detectable, countable, recordable, reportable, tell-a-story-aboutable, analyzable—in short, *accountable*" (Garfinkel, 1967, p. 33, author's emphasis). He located the key to addressing the Hobbesian problem of order in participants' practical reasoning, specifically their methods of accounting for their own actions. This notion, the notion of accountability, is one of fundamental importance to his approach to doing sociology. Actions "are not only done, they are done so that they can be seen to have been done" (Button & Sharrock, 1998, p. 75). Participants' actions are produced in ways that make them recognizable for what they are and, in producing the actions in just that way, members offer an account of what they are doing. When Garfinkel speaks of accountability, therefore, he is concerned with "the ways in which actions are *organized*:

that is, put together as publicly observable, reportable occurrences” (Button & Sharrock, 1998, p. 75, authors’ emphasis).

Actions are accountable in the ways in which they document or give an account of themselves. But they are accountable in another way, as well. In ordinary parlance we use the term *accountable* in the sense of being responsible one to another. This usage has a normative character. As Garfinkel (1967) explained, “In exactly the way that persons are members to organized affairs, they are engaged in serious and practical work of detecting, demonstrating, persuading through displays in the ordinary occasions of their interactions the appearances of consistent, coherent, clear, chosen, planful arrangements” (p. 34). Members are obliged to produce their actions in ways that will appear sensible to others. Actions are accountable, therefore, both in the sense of offering an account of themselves and in the sense that they are obliged to be performed one particular way and not another.

We have methods for doing this. As Garfinkel expressed it, “In exactly the ways in which a setting is organized, it *consists* of methods whereby its members are provided with accounts of the setting as countable, storyable, proverbial, comparable, picturable, representable—i.e., accountable events” (p. 34, author’s emphasis). Heritage (1984) describes Garfinkel’s approach as a “cognitive-moral” (p. 120) one. It leads to a different form of sociological analysis:

Garfinkel consequently turns the problem of social order into a concern with how people organize social actions so that others can make sense of them, so that each person involved in an interaction can identify the actions being performed by others—and thus comprehend the relationship of the actions to the complex of activity under whose auspices they are done, and whose implementation they comprise. (Button & Sharrock, 1998, p. 75)



Agents' orientations to their own actions held little relevance to Parsons' analytic framework, but for Garfinkel, accounts are not only important as material for analysis, but also play a critical role in the creation and maintenance of the social organization itself (Heritage, 1984, p. 34 *et passim*). Garfinkel proposed the name *ethnomethodology* for this approach to doing sociology, one that focuses on the details of how participants accountably produce their actions as sensible. It begins from his policy that they have methods for doing so. The task for sociology, from Garfinkel's perspective, is one of explicating what these methods might be.

### **3. The Accountabilities of the Tool Pass**

To illustrate how an ethnomethodologically-informed analysis of team cognition might proceed, we offer a concrete example. We focus here on the forms of accountability made visible in a simple act, the passing of a tool from a scrub nurse to a surgeon during the course of a surgical procedure.<sup>2</sup> It would be hard to find a setting more deeply steeped in regulation and accountability than the operating theatre. We look here at two examples of tool passing and show how they might be analyzed in terms of how participants offer accounts of what they are doing through their actions.

<<insert Excerpt 1 about here>>

Excerpt 1 provides an abbreviated transcript from an observed operation.<sup>3</sup> The transcribed fragment comes from a 'keyhole' surgical procedure. This means that rather than laying the patient open, the operative procedure was carried out using instruments inserted through small 'ports' in the patient's side. As seen in Figure 1, the surgeon (S) and the scrub nurse (N) were positioned on opposite sides of the operating table. Video monitors were placed across the table from each enabling them to view the interior

space of the patient's body.<sup>4</sup> In the excerpted fragment, the surgeon extracted a tool from the patient's body while issuing a request for a "clip applier" (line 3). His request took the form of a specifying expression and an adverb ("please"). To satisfy the request, his respondent must resolve the referring expression. Sanchez Svensson (2005) noted that there is no standardized nomenclature for surgical instruments. Naming conventions may vary from hospital to hospital and from surgeon to surgeon. The tools of surgery may be known by a variety of names based on function, the inventor of the instrument, the place where it was invented, etc.

<<insert Figure 1 about here>>

Tool changes occur frequently during the conduct of a surgical procedure and small inefficiencies would accumulate over the course of the operation. In this case only 5 sec elapsed from the moment that the first tool was withdrawn from the patient's body to the time when the second was placed into service. The process was executed swiftly and with great economy of motion.

Safety and sterility are also important considerations in this setting. Instruments must be handled in ways that avoid contamination. Surgeons often wear two pairs of gloves reducing sensitivity. Care, therefore, must be taken to avoid dropping tools. Many of the instruments are sharp and must be handed off in ways that avoid injury to the parties involved. Further, every instrument (e.g., scalpel, cautery, scissors, forceps) is designed to be held in a specific way. It falls to the passer to position the tool in the hand of the surgeon so that it can be placed into use without need for reorientation or examination.<sup>5</sup> In this case, the instrument is almost 50 cm in length with a long, thin shaft, a working tip, and a pistol grip on the other end. The nurse lifted the tool from the

end of the shaft, the part that would eventually be inserted into the patient's body, and placed the pistol grip into the surgeon's outstretched hand.

The choreography of this tool pass resembles that of a handshake. The surgeon's hand and the tool arrive at the same instant meeting in a place midway between the two parties (lines 8 and 9). This level of coordination requires careful monitoring of the progress of the ongoing procedure on the part of the scrub nurse and anticipation of what will be done next. Sanchez Svensson (2005) described the situation as follows:

The smooth accomplishment of the passing of instruments is not simply a matter of constantly attending to what others are doing; attentiveness and 'sensitivity to others' conduct is embedded in an understanding of the routine ways of conducting procedures and using particular instruments. It is not that the passing of an instrument is an instant response to a request, but an anticipated and organized accomplishment in and through the developing course of the participant's activities. (p. 176)

<<insert Excerpt 2 about here>>

We might say that timeliness and accuracy are accountable matters with respect to the tool pass, but how would we know that this was the case? One way that this could be demonstrated would be by describing instances in which participants' expectations were violated. Excerpt 2 contains a transcript of a second tool pass from the same operation. As in Excerpt 1, a request was issued (line 3) simultaneous with the withdrawal of a tool from the patient's body (lines 1 and 2) signaling the initiation of a tool pass cycle. The surgeon extended his hand to receive the requested tool (line 4) but, instead of delivering a tool, the nurse asked him to repeat his request. After the surgeon did so, the nurse placed the requested tool in his outstretched hand and the operative procedure went on.

In this case the choreography of the tool pass seems disrupted. The surgeon's hand arrived, but there was nothing there to meet it. Just as an unreciprocated invitation to shake hands is an accountable matter, a failure to produce a requested tool is also an accountable event. Though she had already selected a tool from the table following the request, the nurse did not make it available to the surgeon (see Figure 2). The surgeon's shift of gaze toward the nurse (line 7) inquired into the problem. By not passing the instrument in her hand, the nurse performed an accountable action, one that constituted a withholding. But why did she withhold it? Because it was the wrong tool, of course. Or, more precisely, because she was uncertain that the object in her hand matched the surgeon's specification. Her withholding evidenced this uncertainty.

The surgeon's shift in gaze revealed an expectation violated. By continuing to hold his hand out, he marked that his request remained open and unsatisfied. He displayed his orientation to timeliness and held the nurse accountable for the delay. The nurse's withholding of the tool also displayed an expectation violated. At the stage in the procedure in which this exchange occurred, the work consisted of doing blunt dissection and applying clips to vessels that are about to be divided.<sup>6</sup> A routine sequence of instruments, therefore, might be: blunt-tipped forceps, clip applier, followed by a scissors. Though the tool requested by the surgeon is commonly used within the procedure, it falls outside of this typical sequence and its use, therefore, would be harder to anticipate. Her withholding of the tool within her hand displayed her accountable orientation to producing the *correct* tool. The nurse and surgeon made their orientation to timeliness and accuracy visible to each other and, in so doing, rendered it visible to us as well.

The actions of both parties stand as an account of how they viewed their work, how they understood what they were doing together, and who they were. They did these things in the way they did, not *because* they were nurses and surgeons. Instead, the participants presented themselves recognizably and accountably as nurses and surgeons by doing these things in just the way that they did.

<<insert Figure 2 about here>>

#### **4. A Hybrid Approach to Studying Teamwork**

We have sketched out an example of how an ethnomethodologically-informed analysis of teamwork might be done. By directing attention to the accountable methods through which members of the team produced their actions, Garfinkel offers us a different way to theorize our topic. Rawls (2003) writes:

Garfinkel has opened the way for a new sort of theorizing. ... There is no reason, in principle, why theorists cannot be faithful to the phenomena; no reason why they have to proceed in generic terms. Garfinkel has shown us the possibility of empirical theorizing and it is in these terms that I was to refer to Garfinkel as one of the great social theorists of the twentieth century. (p. 145)

Built into Garfinkel's 'empirical theoretic' approach is an entirely different treatment of shared cognition.

Cannon-Bowers and Salas (2001) wrote, "the concept of shared cognition can help us to explain what separates effective from ineffective teams by suggesting that in effective teams, members have similar or compatible knowledge, and that they use this knowledge to guide their (coordinated) behavior" (p. 196). A variety of names have been attached to the forms of knowledge underlying team performance—"teamwork

competency” (Cannon-Bowers, & Salas, 1997), “team knowledge” (Cooke, Salas, Cannon-Bowers, Stout, 2000), “team mental models” (Mohammed & Dumville, 2001), “team situational awareness” (Stout, Salas, & Cannon-Bowers, 2001), “transactive memory” (Brandon & Hollingshead, 2004). These different formulations reflect different theoretical orientations and would seem to suggest that there might be a variety of different kinds of knowledge relevant to the work of teams. Whatever the nature of the knowledge, however, there seems to be widespread agreement that some form of knowledge sharing is essential to coordinated action.

Garfinkel (1952) wrote:

The big question is not whether actors understand each other or not. The fact is that they do understand each other, that they *will* understand each other but the catch is that they will understand each other regardless of how they *would* be understood. ... The big question for the “problem of understanding” is thus the question of describing the conditions under which men do in fact perceive each other in the ways that they do. (pp. 367-368, author’s emphasis)

Rather than attempting to codify what knowledge is shared, Garfinkel focuses on the organizational details of how the sharing gets done. As Schegloff (1991), recounted, “what seemed programmatically promising to Garfinkel was a procedural sense of common or shared, a set of practices by which actions and stances could be predicated on and displayed as oriented to ‘knowledge held in common’—knowledge that might thereby be reconfirmed, modified, and expanded” (pp. 151-152). The eponymous methods studied by ethnomethodologists are the procedures whereby shared understandings are created, negotiated, and sustained.

The question that motivates this book concerns how might we begin to rigorously and scientifically study the work of teams. Teams have been defined as, “a distinguishable set of two or more people who interact dynamically, interdependently, and adaptively

toward a common and valued goal/object/mission, who have each been assigned specific roles or functions to perform, and who have a limited life span of membership” (Salas, Dickinson, Converse, & Tannebaum, 1992, p. 126-127, quoted in Cooke et al., 2000). Left unasked, however, is how it is that teams constitute themselves as teams in the first place. How would we begin to investigate such a matter? In a recent paper, Rawls (2008) described what ethnomethodologically-informed “hybrid studies of work” might contribute to organizational studies. Her recommendations, however, apply with equal force to the study of teams. Drawing on Garfinkel’s writings, Rawls describes how not only teams, but all social groups are constituted. She notes, Garfinkel “proposes that situated actors, engaged in constructing a sequential order of meaning, constitute a group only when, and only for as long as, the sequential character of the interaction in which they are currently engaged requires of them collectively a mutual commitment to constitutive properties of the situation” (p. 707). This was quite evident in the two instances of tool passing that we examined earlier. The nurse and surgeon displayed a mutual orientation to the accountabilities of the task at hand.

Hybrid studies of work focus upon just how a local sense of orderliness is produced. This is seen, not in a study of abstracted features, but rather in the study of how participants make visible the accountable aspects of their concerted activity. Rawls writes, a “focus on detail in habits and routines does not look for order, nor treat meaning, intelligibility or mutual action as a matter of order” (p. 706). “The workers are pictured as managing to enact just the right routines at the just the right time, and the question of how they know when or what is not problematized” (p. 706). We need to look beyond such features to the ordering accountabilities that lie behind. She proposes, “What is required for the study of how this order is jointly made is a method that preserves the contingencies of its local production, those sequential details oriented

toward by workers in doing their work and a theory treating these contingencies themselves, not the routines and habits an observer might see ‘sedimenting’ from them, as essential” (p. 706).

When any specific case is reduced to a count-able within an externally-imposed theoretical category, we risk losing our grasp of the ordering properties of the setting of production, its local contingencies, and its observable accountabilities. This is the basis for Garfinkel’s methodological prescription that cases be studied in their practical details. He “is interested in how—just how—contingencies are rendered as recognizable objects using shared methods that exhibit an immediate order that *can* be seen in each single case” (Rawls, 2008, p. 704, author’s emphasis). To begin to understand the work of teams from an actor’s perspective, we need to start collecting study-able instances of just what we are taking teamwork to be and augment them with carefully constructed analyses designed to document the vernacular methods by which the participants carry out their work. The enterprise is *empirically grounded*, not only in the sense that it directly studies teamwork as a naturally-occurring phenomenon, but also because it retains a record of the circumstances under which each analyzed instance arose (much as we have done here with the tool pass examples). This enables the reader of an account to reconstruct the analyzed event and thereby evaluate the adequacy of its analysis.<sup>7</sup>

Teams become teams in the ways that members locally manage the accountabilities and contingencies that shape their work. To develop a grasp of the “just whatness” of teamwork, it needs to be studied as a “thing-in-its-details” (Garfinkel & Livingston, 2003, p. 23). This represents a proposal for an “incommensurable, asymmetric, and alternate” (Garfinkel, 2002, p. 192) approach to building a science of teams.



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## 6. Endnotes

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<sup>1</sup> His book, *The Structure of Social Action*, examined and sought to integrate the writings of Alfred Marshall, Vilfredo Pareto, Émile Durkheim and Max Weber. Durkheim and Weber are foundational theorists in sociology. The other two, Marshall and Pareto, were polymaths, also known for their contributions in economics and social philosophy.

<sup>2</sup> Garfinkel and Livingston (2003) use formatted queues as an everyday example of a methodically-ordered social activity. Heritage (1984, Chap. 5) uses the example of a greeting exchange. Note that issuing a greeting or forming a queue are not methods, as we use the term here, but instead depend upon an array of more fundamental methods for recognizing that a greeting has been issued, for displaying that one is standing in a line, etc. The same is true for tool passes.

<sup>3</sup> The transcripts are prepared using the notational conventions of Conversation Analysis (Jefferson, 2004). Spoken speech is presented in bold face to set it off from the other action descriptions. Square brackets mark actions that occur in overlap. Text enclosed in angle brackets (e.g., line 31 in Excerpt 3) was produced at a more rapid tempo than surrounding text. A colon indicates a prolongation of the preceding syllable. The number enclosed in parentheses in line 32 indicates a pause measured in seconds. Underscoring of the first three letters in “curved” indicates stress. The column to the left contains time code marking the onset of the action appearing in that line.

The recording analyzed here comes from the Southern Illinois University Surgical Education Video Archive. This is a collection of videotaped surgeries gathered over a decade at two teaching hospitals affiliated with the medical school. Further information about the video archive can be found at: <http://www.siumed.edu/call/index.html>.

<sup>4</sup> See Mondada (2003) and Koschmann, LeBaron, Goodwin, & Feltovich (2010) for a more elaborate discussion of visualization in endoscopic surgeries.

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<sup>5</sup> There is clearly more to it than this. See Sanchez Svensson, Heath, and Luff (2007) for a detailed description of how a particular instrument might be passed in different ways depending on the task at hand.

<sup>6</sup> See Koschmann, et al. (2010) for a more detailed description of this particular operative procedure.

<sup>7</sup> This opens into a broader discussion of the 'validity' of an analysis, which we will not pursue here. Interested readers might consult Seedhouse (2005).

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*Figure 1.* Layout of the surgical workspace showing the relative positions of the surgeon (S) and the scrub nurse (N) to their respective video monitors.

*Figure 2.* The surgeon extends his hand and looks to the scrub nurse. The scrub nurse holds a clip applier in her right hand.

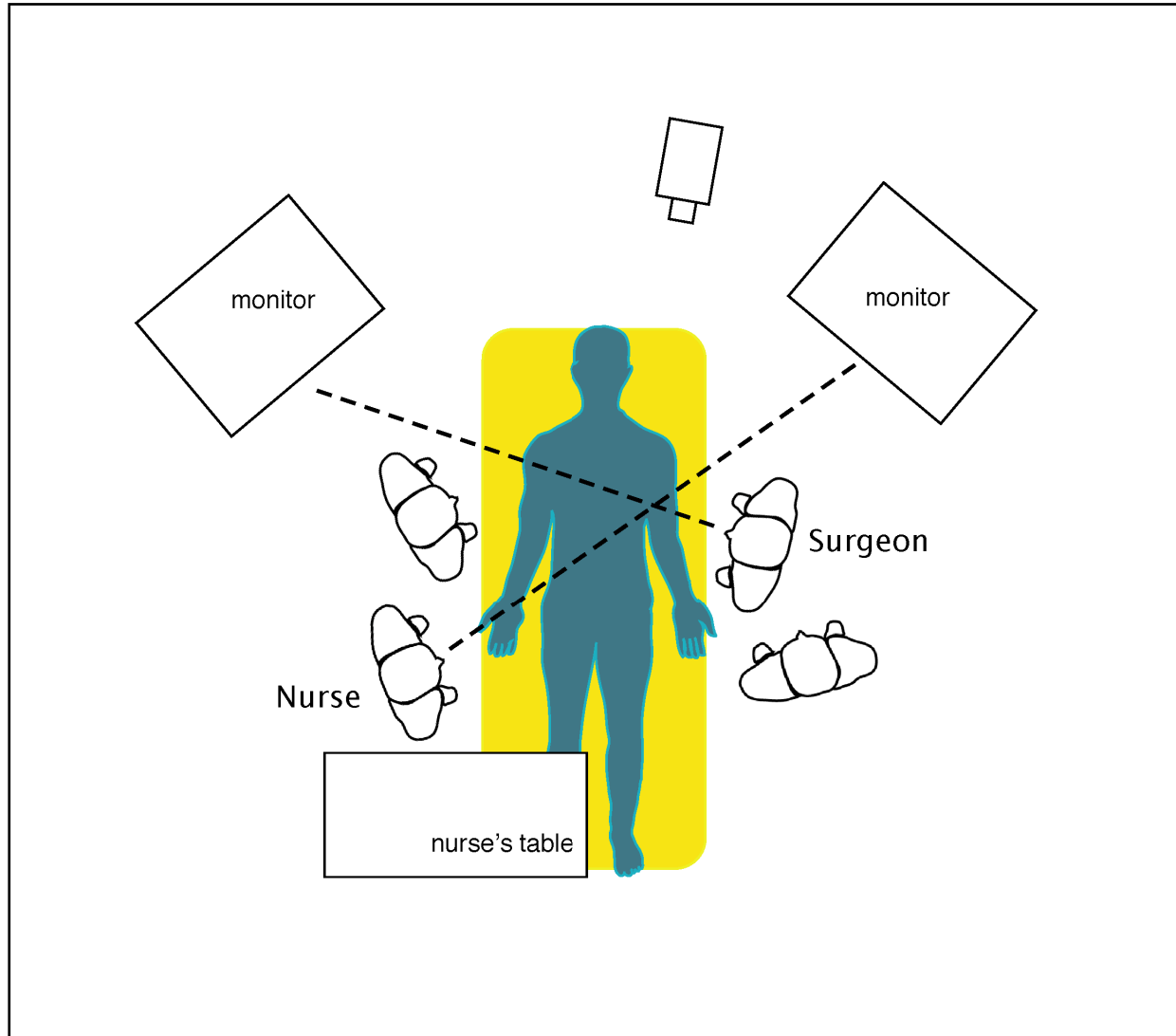


Fig.1



|00:09:10;26|

S: Maryland.

Fig. 2