Resident Hesitation in the Operating Room: Uncertainty in the Context of the Principle of Progress

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THESIS

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Dedication

This work of scholarship is dedicated to all the surgical teachers and mentors that have invested their lives in not only their patients, but in their students. No one achieves success on their own and I am grateful to those who invested in me.
Acknowledgements

I want to give my most heartfelt thanks to Drs. Bordage, Schwartz, Lingard and Goldszmidt for their support, mentorship, and advice without which this work of scholarship would not have been possible.

I also want to thank my wife Mary and my children Cate and Ally for their continual understanding and support. The work I do is not easy and often requires sacrifice of my family as well as myself. Thank you for loving me and supporting me throughout my career.
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Abbreviations

PGY  Post Graduate Year
REB  Research Ethics Board
Summary

In postgraduate medical programs, ‘progressive autonomy’ encourages residents to face moments of uncertainty. We explored the phenomenon of 'hesitation,' triggered by uncertainty, in the context of the operating room in order to understand the social behaviors surrounding supervision and progressive autonomy.

Nine surgical residents and their supervisors were selected from a Canadian medical school. Each resident-supervisor pairing was observed during an operative procedure and subsequently participated in separate post-observation semi-structured interviews. Constructivist grounded theory was used to guide the collection and analysis of the data.

We found that teaching and learning in the operating room is heavily influenced by the principle of progress. The principle of progress suggests that maintaining progress throughout an operative procedure was a highly valued norm by both supervisors and residents alike. Resident hesitation was often the first indication of a disruption to this principle of progress. A lack of resident progress during a procedure was perceived by supervisors as a sign of incompetence and influenced the teaching-learning process.

We considered the implications of these three newly described phenomena, that is, the principle of progress, the meaning of hesitation, and influence on judgments of competence, for teaching and learning in direct supervision settings such as surgery. Medical educators, by being aware of these phenomena, could maximize their teaching-learning moments and foster progressive autonomy.
I. INTRODUCTION

Postgraduate medical training is based on experiential, work-based learning in clinical settings where residents provide actual patient care in a supervised manner. In these settings, residents assume graduated responsibilities as they move towards the program’s goal of producing competent, independent practitioners (1). The notion of ‘progressive autonomy’ is entrenched as a guiding principle in postgraduate medical programs (2). This educational principle necessarily and purposively puts residents in situations where they function at the edge of their comfort level. This approach is based on the belief that such situations offer maximal learning opportunities (1,3,4). Progressive autonomy requires both residents and their supervisors to make high-stakes, complex judgments. Residents must judge when to ask for help, while supervisors must judge when to provide assistance. The notion of progressive autonomy, particularly in the educational contexts of internal medicine and emergency medicine, has come under scrutiny during the past decade (5-7), leading to growing public concerns regarding patient safety and calls for increased supervision of junior residents (8-10).

Progressive autonomy requires residents to judge whether or not to seek help in high-stakes clinical situations. These judgements can be strongly influenced by the belief that independence is equivalent to competence (4,11-15). Kennedy extended this notion by suggesting that residents weigh factors beyond their own perceived competence when considering whether to seek advice from supervisors, such as the importance of the clinical question, the approachability of the supervisor, and the desire to demonstrate independence (4). Residents’ willingness to seek help is also influenced by their assessment of the effect that requesting assistance may have on their own credibility (4,11). This stems from the belief that residents may be evaluated poorly if they ask for help too soon or too frequently.
Likewise, supervisors must judge when to provide assistance and when to let residents work independently. Past research suggests that a number of factors shape these decisions, including prior acquaintance, apparent self-confidence, work efficiency, medical knowledge, and residents' communication skills (14,16). Paramount among factors is supervisors' perception of residents' ability. Kennedy concurs and depicts supervision as a continuum of involvement in patient care, ranging from routine oversight, responsive oversight, directing patient care, and backstage oversight (13). Minimal supervision may suffice in situations of perceived high resident ability, whereas active oversight may be necessary in situations of perceived limited resident ability. Shifts in the degree of oversight are informed by supervisors' assessments of the resident’s trustworthiness and by cues signaling a concerning situation (13-15). Thus, supervisors tend to base their level of assistance on their perceptions of residents' ability.

Existing research portrays clinical supervision as a complex social phenomenon in which residents and supervisors are influenced by multiple factors when choosing to seek or offer help (4,11-18). This research, however, has been conducted predominantly in internal medicine programs in which supervision is often indirect (1,6), that is, residents complete most of their work away from supervisors and supervisors make second-hand assessments based on language cues and third-party reports (13). Consequently, the social interactions between residents and supervisors during direct supervision remain relatively unexplored; in particular, we know little about the influences of teacher and learner proximity on help-seeking and supervisory oversight.

Direct supervision occurs in many training settings, such as the emergency department, critical care, anesthesia, and surgery. The operating room provides a propitious site to explore the influences of teacher-learner proximity on resident help-seeking behaviors and supervisory oversight. In the operating room, judgments about help-seeking and assistance-giving take place in person and in the moment. A
common anecdote in this setting is that some residents, when overwhelmed by unexpected circumstances, do not seek help – instead, they hesitate and, in some situations, may even 'freeze' and halt progress completely. Often supervisors believe that residents possess the fundamental skills, both technically and cognitively, to rise to unexpected challenges, but are unable to adapt and maintain progress. In our experience, the phenomenon of resident hesitation is a recurrent and recognizable feature of surgical education, especially in the operating room. However, hesitation has not been systematically described, nor empirically explored in relation to how residents and supervisors negotiate progressive autonomy. The purpose of the present study was to better understand the hesitation phenomenon and its place in the complex social behaviors surrounding direct supervision and progressive autonomy.
II. METHODS

A constructivist grounded theory approach was used to guide the collection and analysis of hesitations in the operating room. This methodological approach is used to develop a theory of a social phenomenon by reflecting on emergent ideas from the data and building on sensitizing concepts from existing literature (19). Constructivist grounded theory acknowledges that meaning is created through the interaction between the investigator and those being investigated (19). This notion is an important feature of our methodological orientation given that the principal investigator is a practicing surgeon and a surgical educator. The study received Research Ethics Board (REB) approval from Western University and the University of Illinois at Chicago. All participation was voluntary and consented; participants were made aware of the objectives of the study presented in an information letter as part of the consent process.

A. Sample

A sample of surgical residents from the Division of General Surgery and their supervisors were recruited from two separate clinical sites in a single large Canadian medical school. Senior surgical residents in their fourth or fifth post-graduate years (PGY) were selected for two main reasons. First, they are given graduated responsibility in the operating room and therefore experience progressive autonomy practices. Second, they are most likely to encounter the situations we sought to study, such as procedural challenges arising from uncertainty or judgment, rather than from a lack of technical ability or anatomical knowledge. Technical skills, while essential, are teachable and easily measurable. In contrast, surgical judgment is difficult to define and often considered the true measure of competency. This sampling allowed for an exploration of more advanced aspects of competency and judgment. A combination of purposive and convenience sampling was used to create surgical resident-faculty supervisor pairings from the two sites. Pairs were sought until data saturation was achieved.
The surgical procedures for the pairings were chosen based on the pairs recruited, with attempts to include a range of procedures.

B. **Data Collection**

The resident-supervisor pairings were observed during a surgical procedure by a non-participant observer (MO) who is an experienced surgeon and surgical educator. Field jottings were taken during the observations and later elaborated in reflective field notes. The field notes contained details of the operative procedure as well as patterns in resident-supervisor interactions, such as physical behaviors and verbal and nonverbal communication. No patient-specific data or observations of other members of the surgical team were recorded.

Immediately after each procedure, both members of the resident-supervisor pairing participated in separate, confidential, and semi-structured interviews conducted by the same observer (MO). This post-observation interview technique is common in naturalistic studies of expert decision making because it encourages participants to recollect challenging and uncertain moments that may otherwise be overlooked in the spontaneous recall of the procedure (20). The interviews consisted of generic probes from a semi-structured interview guide and case-specific probes prompted by the observations. Interviews were recorded and transcribed verbatim. Supervisor interviews were labeled S1-9 and corresponding resident interviews were labeled R1-9.
C. Data Analysis

In line with a constructivist grounded theory methodology, data analyses followed an iterative process to allow sampling sufficiency (21), in which probes for later interviews were refined by early analytical insights, towards the robust and detailed understanding of emerging key themes. The interview transcripts were repeatedly analyzed using a constant comparative approach: instance was compared to instance, transcript to transcript, code to code, and theme to theme. This coding structure was applied to batches of transcripts until one researcher (MO) had read and coded all data multiple times. Regular meetings between three researchers (MO, LL, MG) were held to discuss the coding scheme throughout its development and application. Once the data had been organized according to thematic codes, relationships among these themes were formally explored through a process of discussing, exchanging memos, and returning to salient and discrepant examples. The result was a systemic description of what resident hesitation looks like, how its meaning is shaped by the principle of progress, and how faculty interpret this meaning. Themes and codes were then presented as a work in progress to members of the Department of Surgery as a means of member checking.
III. RESULTS

A total of nine resident-supervisor pairings (18 subjects) were recruited and a total of 15 operative cases were analyzed. We observed between 1 and 4 hesitations in each case and 3 instances of “freezing” altogether (see Table 1 for details).

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<tr>
<td>Freezing events</td>
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<td>1</td>
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Three core themes began to emerge after analyzing the first 5 cases, namely: the principle of progress, the meaning of hesitation, and judgments of competence. Saturation was reached after 9 pairings and 15 cases. A member-checking exercise was conducted with the faculty in the Division of General Surgery at the main institution during an oral research presentation and discussion; all agreed with the themes presented and no missing interpretations were noted. Each theme is described below, accompanied by examples from the observations and interviews.
A. **Principle of Progress**

The first theme, the principle of progress, was a highly valued tenet of surgery for all participants. Residents reflected, "we have to always be moving forward in the surgery" (R8). Failure to uphold this principle was defined as reaching "a point where we’re not making forward progress and things are stopping" (R6). While residents and supervisors uniformly viewed a lack of progress as problematic, this principle was also recognized as an ideal that was not always attainable. For example, one resident said, “obviously I would want to have flow throughout 100% in every case, but as you well know, not all patients are the same and not all cases go fairly equally” (R8). Nevertheless, the goal of constant progress was strongly held by supervisors, who often said, “progression is absolutely essential” (S7).

The presence of time pressure in the operating room was central to the principle of progress. Residents and supervisors reported instinctively knowing when progress was delayed and described using an internal reference or clock to measure progress. One resident exemplified his sense of time and progress by saying, “I know there are time pressures in the operating room and it seemed a part of the case that should happen in just two seconds. The whole thing seemed too long” (R4). While, residents and supervisors described time pressure as an underlying rationale for maintaining progress, a lack of progress could be perceived as holding greater significance than simple delay. Procedural delays could be minor or, as one resident described, come to a complete halt or freeze: “then I know I’m stuck, because in an operation you are flowing, you’re doing it, and suddenly you’re at a place where you’re not sure what the next step is, and it all stops” (R2).

B. **Meaning of Hesitation**

The second theme to emerge was the meaning of hesitation, which was strongly informed by the principle of progress. Hesitation was a temporary pause in a resident's activity potentially resulting in a
disruption to the progress required for a surgical procedure. Hesitation was often the first indication of an impending disruption to the principle of progress. It was witnessed during field observations and described in the interviews. In several instances more than one hesitation event was observed within a case, but freezing occurred in only two cases with one case having two freezing events. The behaviors of the residents during cases in which multiple hesitation events occurred did not differ substantially from cases in which only one hesitation event was observed. In some instances the supervisors seemed to engage in behaviors that limited opportunities for hesitation while others did not alter their approach. In instances of multiple hesitations, supervisors did not appear to modify their supervisory style in response to hesitations by the resident. Participants described hesitation as a regular occurrence in the operating room and recognized that it reflected something more than just a temporary pause using the terms “hesitation” and “uncertainty” almost synonymously. Although hesitation was generally experienced as a transient interruption, it could lead to a more permanent disruption or freezing. The following excerpt from the field notes illustrates the characteristics of a hesitation event that extended to freezing:

“The resident has stopped moving, they are looking at the incision and the suture in the needle driver but all movement has stopped. The difficult part of the procedure is done; just closure of the fascia is needed. There is an awkward silence. No one says anything and everyone appears uncomfortable. The situation lasts a short time -- 45 seconds or so -- but given the constant activity prior, this seems like an abrupt halt. The silence is broken by the supervisor asking in a harsh tone, “you don’t know what you’re doing?” The resident doesn’t answer. The surgeon’s frustration and disappointment is made palpable by his/her body language: he/she snatch[s] the instruments from the resident and takes over, commenting about what could have improved the situation, “adjust the lights, get retractors, make your assistants help you.” The comments are made almost in a mocking tone, rather than in a supportive, educational way” (Field note: R2S2C1).

The complete lack of progress in the above example illustrated resident hesitation in its most extreme form, that is, freezing.

Supervisors recognized hesitation by observing changes in residents’ behavior. As one supervisor explained, “you can tell from the uncertainty of their manoeuvres, the way their hands are working, their
posture and the look in their eyes” (S3). Similarly, residents also indicated that particular behaviors signalled uncertainty. One resident said, “[supervisors] probably see that you stop anticipating. You’re not assisting well. You probably stop doing a lot of things really. They probably notice a change in how proactive you are” (R1). Both residents and supervisors acknowledged that the degree of social interaction, body language, and physical movements all functioned as signals to the supervisor that a resident was uncertain.

Although supervisors viewed hesitation as a sign of uncertainty, this was almost always an inference because residents rarely communicated their uncertainty explicitly. This notion is illustrated in the following surgeon’s comment, “It becomes clear after a pause or an awkward moment in the surgery that the resident isn’t clear on what the next step of the operation is. That usually becomes apparent but it’s not usually something that’s articulated. No resident I can recall has ever said to me “I don’t know what to do next”. But you can guess when they don’t know what to do. You can feel that suddenly things grind to a halt” (S8).

Consistent with this assertion, residents confirmed that although uncertainty was often the trigger for hesitation, they were reluctant to openly disclose that uncertainty. For example, one resident said, “I would think, ‘well I’m lost now. I don’t know what we are doing and where we are going next.’ I don’t necessarily vocalise that, maybe a little out of pride. I don’t want the surgeon to know I’m lost” (R1). Supervisors, however, reported little difficulty inferring uncertainty from behavioral shifts.

We observed some instances in which supervisors reframed the hesitation into a teachable moment and engaged in behaviours that prevented further hesitation. These behaviours were complex and will be presented in a follow-up manuscript. For example, a supervisor created a teachable moment
out of hesitation by guiding the resident, an act that physically limits resident’s choice of actions, as a mechanism to resume progress. The supervisor reflected, “once they start getting off the plane they slow down. Then I do something with my fingers or instruments to guide them back to the plane” (S5). Guiding was considered an effective way of teaching when residents became stuck, allowing them to get back on track and resume the procedure. For example, “so then they freeze and I think they may be in a way panicked internally and forget completely what to do next. And so, in an effort to avoid doing the wrong thing or being reprimanded, they do nothing. And so there is no point in asking them, I just re-direct them and then they go” (S4).

C. **Judgments of Competence**

The final theme was judgments of competence. This theme reflects participants’ reports that a resident's competence comes into question if they hesitate during an operative procedure. The notions of competence and hesitation were highly interrelated during the interviews, but did emerge as distinct themes. In almost every instance of hesitation, participants described the implications that the phenomenon may have for their ongoing judgments of the resident’s competence. Although hesitation was not the only measure of competence identified, according to both residents and supervisors, it played an influential role in moment-to-moment judgments of competence.

Residents reported that their reluctance to disclose uncertainty in moments of hesitation was due to their impression that uncertainty could signal incompetence and result in a negative assessment. One resident said, “I over think every step and then I become hesitant. I say, well, these five millimeters have to go this way or that and then I find I am just more hesitant and then it makes it probably appear like I don’t know what the next step is” (R2). Many residents shared the concern that hesitating was bad for appearances and “conjures up negative thoughts” (R8) in supervisors. They described such occurrences
as anxiety-provoking due to the assumption that hesitation means uncertainty, and uncertainty means incompetence: “I think we’re all a little bit afraid when things are not smooth that our skills might be sub-par for our level” (R6).

Although supervisors acknowledged that hesitation was part of the learning process, they confirmed residents’ concerns that it may conjure notions of incompetence. Supervisors recognized that “residents are fearful of looking incompetent and being judged compared to peers” (S8), and thus attributed multiple meanings to hesitation. One supervisor said, “they pause for different reasons. Ultimately it’s a judgment problem. The first problem is they don’t have the insight to say, ‘I don’t know what to do next. I’m stuck’. So that’s a problem of not knowing what to do and not knowing enough to say I don’t know. The next pause is because they technically don’t know how to fix something” (S6).

Residents also reported interpreting hesitation as a marker of incompetence. These interpretations, and their related decisions about whether to reveal their underlying uncertainty, were based in part on a sense of what they ‘should be able to do’ at their level of training. One resident commented, “I think that it all should happen now that I am a senior resident. And I’m failing at this. I’m locking up, and so I lock up on that feeling” (R2). When residents perceived the situation as one they ‘should’ be able to handle, they reported being less likely to reveal their uncertainty. As one resident put it, “I don’t want to let the surgeon know that I am lost... As the senior on the case you don’t want to appear that you’re in over your head, but often you are early on” (R1). In contrast, if residents perceived themselves to be in a situation beyond their level of training, they expressed more comfort in communicating their uncertainty. In describing such a situation, one resident reasoned, “I sought the information out myself [from my attending], because I needed the information [about how to make the skin cut]... I hadn’t done a breast case for a long time, they knew I had been in the ICU for my fellowship,
and the first thing you do is make the skin cut, I would hate to make the wrong cut” (R5). Thus, residents indicated that their decision to disclose their uncertainty depended on whether or not they thought the situation was appropriate to their level of experience.

Supervisors also referred to ‘performing at an appropriate level’ in their assessments of hesitation; hesitation could be either expected or problematic depending on their preconceived notions of residents' level of training and progress. For example, one supervisor perceived a third-year resident's ‘guarded’ movements as a signal of a chronic confidence issue: “You would think that it is a guarded manoeuvre of a medical student or PGY-1, not a PGY-3. I’m still faced with this every time. So I sit down with him/her and say why are you so scared to progress through this? Why don’t you operate with some confidence? You’re becoming a scared surgeon and you’re not even a surgeon yet” (S2).

Both supervisors and residents admitted to making repeated judgments of competency during moments of hesitation. However, we did not observe any explicit instances of such judgments being verbalized during the nine observed cases. Most communication about hesitation appeared to be tacit. As one supervisor said, “no resident that I can recall has ever said to me, ‘I don’t know what to do next’” (S8). Residents acknowledged that uncertainty was something they generally endeavoured to hide from their supervisors. They expressed concerns “about eliciting negative feedback and then doing even worse and it becomes a bit of a negative cycle” (R2). In addition, they worried that “not knowing what to do and asking, having to say I need help” may result in “having to change sides,” thus being demoted to assisting rather than operating (R8). While residents sought to conceal their uncertainty, supervisors reported that they could readily identify such events.
During discussions with the residents and supervisors, it became clear that there was a tacit understanding by both sides that competency decisions were being made independently yet withheld from the other party and that neither side wanted to break the lack of acknowledgement. There was no direct mention of a “game” in the transcripts, yet on review of the field notes and transcripts together, the concept of a game of opposed wills (game of chicken) began to emerge. This was only identified late in the analyses and consequently no follow-up questions about this was included in the interviews. This is a topic deserving future exploration.
IV. DISCUSSION

We identified three interrelated themes regarding resident hesitation in the operating room: the principle of progress, the meaning of hesitation, and the judgment of competence. Maintaining progress throughout an operative procedure was a highly-valued governing principle that shaped how hesitation was understood by both surgeons and residents. Resident hesitation, triggered by uncertainties, was often the first indication of an impending disruption to the principle of progress. A lack of progress of any kind during an operative procedure was considered problematic. This strongly held value may influence supervisors' perceptions that hesitation is a signal of resident incompetence.

A. Resident uncertainty and the principle of progress

Resident uncertainty has been richly described as a common phenomenon during clinical training. However, past research focused on situations in which residents and supervisors were separated in both time and place such that the influence of time was not markedly visible to investigators. For example, Kennedy and others have shown that residents avoid seeking help when uncertain in order to not appear incompetent (11,17,22), but they did not discuss how such avoidance impacted the timely progress of clinical care. In fact, previous research regarding uncertainty could not specifically focus on the phenomenon of hesitation because hesitation can only be discerned in the context of a shared and recognizable forward pace of motion.

The phenomenon of resident hesitation within surgical education is strongly influenced by the omnipresent importance placed on the principle of progress. This principle is so ingrained in both teachers and learners that it may disrupt teaching and learning in the operating room, particularly when supervisors respond to hesitation by taking over the case. The influence of time on supervisory
interactions is not unique to surgery. Goldszmidt’s exploration of supervisory styles in internal medicine settings suggests that time pressures have a central influence on practice (23). In particular, he argues that the “direct care supervisory style” arises in part due to the supervisor’s concerns about residents' ability to handle the complexity of care in a timely fashion in the context of high workload; this results in supervisors doing tasks themselves rather than supporting residents in doing them (23). A distinguishing feature of our findings is that, in the operating room, concepts of time pressure and workload are intertwined and encapsulated into the notion of progress and it is the threat to progress that appears to tip supervisors into a ‘direct care’ supervisory mode.

We echo Goldszmidt’s caution that learning may be sacrificed when supervisors take over care due to time pressures (23). Pressures on surgical units continue to demand decreases in cost and increases in efficiency (24), which may create a systematic and direct affront to surgical education. While these economic pressures reinforce the importance of time as a major component to the principle of progress in the minds of residents and supervisors, time, in and of itself, should not be the main driver. Supervisors taking over a case must ensure that valuable teachable moments are not lost as a sacrifice to efficiency. While we would not suggest that supervisors challenge the principle of progress, we wonder about the ways in which progress can be preserved while at the same time ensuring that high-quality educational interactions are still occurring in the operating room.

B. **Hesitation that impedes progress signals incompetence**

The perceived association between hesitation and a lack of competency was made clear by both residents' and supervisors' negative judgments following a hesitation event. These judgments can also have a direct impact on resident learning, especially regarding resident help-seeking behaviors. Surgical training in the operating room differs from other clinical teaching settings, in part because residents are
under direct supervision. Therefore, these competency judgments likely occur because resident-supervisor interactions take place in the moment, in person, and under the time constraints of a surgical procedure. The distinction between the operating room and other clinical education settings can be contrasted with Kennedy et al.’s study of internal medicine residents during emergency consultations. They observed that hesitant residents engage in various types of rhetorical behavior, such as delaying to ask for assistance, in order to preserve their credibility (4). In contrast, surgical residents under direct supervision cannot avoid asking for assistance because their supervisors are directly observing their uncertainty. However, surgical residents do admit to stalling with the intention of maintaining the illusion of progress. While most supervisors are aware of the stalling technique, very few viewed hesitation events as teachable moments and many responded by taking over.

One alternative might be for supervisors to consider events such as hesitation as a cue for teaching and actively seek to create interactions with the explicit intent of allowing residents to progress beyond their hesitation. To respond to stalling by taking over may rob the interaction of a salient moment in which residents can advance their competency. Furthermore, supervisors could reflect on whether they are encouraging stalling by not responding to hesitation at all. This supervisory practice may lead to residents “plowing through” or even possibly to the commission of an error by a resident unwilling to acknowledge their limits. Thus, the aim during stalling should not be to preserve the appearance of competency, but to realize the opportunity to extend the range of an individual resident’s competency. By being aware of subtle cues, supervisors could then negotiate ways to promote learning. Thus, the interactions that occur during a hesitation, rather than serving to shut down the learning process event could serve to promote learning. Specifically exploring these resident-supervisor interactions, the object of a separate publication currently in preparation, could provide insight into how to use hesitation events to foster positive teaching-learning moments in the operating room. For this to occur, hesitation needs to
be substantively reframed in surgeons’ and residents’ minds. One way of reframing this practice is to characterize hesitation as an early stage of what Moulton et al. (25,26) call experts’ ability to “slow down when you should.”

C. Re-framing resident hesitation: Is hesitation equivalent to non-expert slowing down?

In our study, resident hesitations within the context of the principle of progress were invariably ascribed a negative connotation. This finding is in direct opposition with the positive connotation ascribed to experts’ slowing down in Moulton et al.’s studies of surgical expertise (25,26). Yet from an observational standpoint, slowing down by experts and hesitation by residents appear to be similar events within the progression of an operation. So why is one perceived negatively and the other positively?

Moulton et al. argue that the ability to shift cognitive processes is a key aspect in surgical expertise (25). Shifting cognitive processes involves knowing when to go from an automatic mode to purposeful, effortful actions. This shift, or as Moulton et al. call it, “knowing when to slow down”, gives experts time to manage difficulty and uncertainty (25, 26). Slowing down can be triggered by a complexity anticipated pre-operatively or by unplanned situational responsiveness based on emergent intra-operative challenges (25).

In many ways, resident hesitation resembles the unplanned slowing down that Moulton observed in experts. Similar to experts, residents recognize the need to hesitate when they are uncertain of how to proceed. Residents in our study asserted that they often use this time to find a solution to the problem on their own. While on the surface hesitation may seem like residents' equivalent of experts' situational awareness, they represent two distinct constructs.
This distinction is directly related to the omnipresent principle of progress. Slowing down in experts is considered a sign of good judgment that will eventually lead to the resumption of progress. In contrast, resident hesitation is perceived as a sign of incompetence because it can result in a disruption to progress that, if not assisted by supervisors, can lead to freezing. Slowing down in experts and hesitation in residents differ in the inherent ability of the individual to resolve the dilemma encountered. When slowing down, experts possess the cognitive capacity and ability to work through difficult moments of a procedure (25). Residents faced with uncertainty often cannot resolve the situation without the advice or intervention of their supervisors. Thus, slowing down behavior exhibited by experienced surgeons is viewed as an example of expertise, whereas hesitation behavior observed in residents is generally attributed to a lack of competence.

However, in light of Moulton’s work, we argue that resident hesitation may be an early stage of experts slowing down. As such, we would suggest that supervisors need to reframe hesitation events as teaching-learning moment, instead of considering them as a sign of incompetence. Rather than taking over, supervisors could consider other possibilities such as guidance through the hesitation event. Such practices could facilitate residents' advancement to the next level of competence and model experts' slowing down behaviors. Supervisors may empower residents by guiding them through the inner workings, thoughts, and judgments of a procedure, as well as modeling behaviors they will need to emulate in future situations of uncertainty. Supervisors taking time to teach in these moments will invariably feel the push to truncate the teaching because of time constraints and will need to guard against this as these moments may be required to advance a resident's competence and therefore ability to maintain progress.
D. Conclusion

We explored how resident hesitation is understood in the context of surgery’s strongly held principle of progress. Hesitation events are commonly treated as evidence of incompetence, when they might be conceptualized instead as learning opportunities and early instances of what will mature into experts slowing down. Supervisors can consider how the principle of progress may be influencing their responses to hesitation and work to realize the full learning potential of the moments when residents work at the edge of their competence. Understanding these phenomena can have broader implications for situations in which teacher-learner relationships are subject to time pressures and direct supervision, such as anesthesia, emergency medicine, and critical care. As medical educators acknowledge the influence of the principle of progress on supervisory interactions, they may be better able to maximize teaching-learning moments during which expert cognitive processes can be made explicit and progressive autonomy can be fostered.
CITED LITERATURE


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