Learning safely from error: reconsidering the ethics of simulation-based medical education through ethnography

Dr. Caroline Pelletier

Department of Lifelong and Comparative Education, UCL Institute of Education, 20 Bedford Way, London WC1H 0AL, UK

Professor Roger Kneebone

Imperial College, Academic Surgery, Chelsea and Westminster Hospital, 369 Fulham Road, London SW10 9NH, UK

Corresponding author: Dr. Caroline Pelletier, c.pelletier@ioe.ac.uk

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‘Human factors’ is an influential rationale in the UK national health service to understand mistakes, risk and safety. Although there have been studies examining its implications in workplaces, there has been little investigation of how it is taught, as a form of professional morality. This article draws on an observational study of human factors teaching in four hospital simulation centres in London, UK. Its main argument is that the teaching of human factors is realised through an identification and positive evaluation of ‘non-technical skills’ and the espousal of ‘non-judgemental’ pedagogy, both of which mean that mistakes cannot be made. Professional solidarity is then maintained on the absence of mistakes. We raise questions about the ethics of this teaching. The study is situated within a history of ethnographic accounts of medical mistakes, to explore the relationship between claims to professional knowledge and claims about failure.

Keywords: mistakes; human factors, hospital ethnography, educational ethics, simulation-based medical education

How do doctors learn from their mistakes? This question has featured in hospital ethnographies over the last sixty years. Everett Hughes (2011, 93) considered it within the broader context of the difficulties facing the workplace ethnographer: 'As soon as we go into these problems [studying mistakes at work], we are faced with defining what a failure or a mistake is in any given line of work or in a given work operation. This leads to still another, which turns out to be the significant one for the social drama of work: who has the right to define what a mistake or a failure is?' The ethnographer cannot claim this right, Hughes emphasises, by studying criteria for success and failure, since their application is rarely subject to consensus. The right to define a mistake is indeed consequent upon full membership of the 'colleague group'; laymen are not considered able to understand the contingencies of work. And when mistakes do become subject to public discussion, fear is generated from two potential consequences: that the colleague group's prerogative is undermined, and that the inquisitor 'lifts the veil from the group's own hidden anxieties' (95). Hughes suggests that this is why professionals – from doctors to teachers – are nervous when ethnographers report back to them. Responding to, and learning from, an account of one's work which might identify mistakes is a daunting prospect.

Hughes' argument presents mistakes at work as a phenomenon that puts into question the ethnographer's membership and understanding of the group under study as well as the ethics of the research practice, notably what she or he offers back to research participants. Both of these considerations are important in the study we discuss here, which involved investigating how teaching and learning happens in the simulation centres of several London (UK) teaching hospitals. Such centres have been built over the last seven years or so, to enable doctors learn from and about mistakes

(CMO 2008, Gaba 2004). The study was commissioned by the London Deanery, the body responsible at the time for postgraduate medical education, as part of its efforts to promote the use of simulation, which included funding teams of clinical and education researchers – hybrid groups of colleagues and non-colleagues – to investigate how medical education was done, and ideally, report back on its effectiveness. This article is an answer to that request, although we don't say whether simulation is effective or not. Instead, we describe simulation as a novel site of discussion about who has the right to say what a mistake is. This discussion is not confined to the research setting, but played out in this article as well.

With respect to the research setting first: what is taught through simulation is a distinct rationale for medical mistakes called human factors – we will describe how these were defined in our sites of research. The term commonly appears in safety policies across the UK's national health service (NHS), following the publication of reports, such as *To err is human* (Institute of Medicine 1999) and *An organisation with a memory* (DoH 2000), which emphasised that mistakes were ignored in medical culture, and that medical professionals should learn from approaches in aviation and nuclear power. The virtue of human factors is that it appears as a rationale developed outside medicine, where mistakes are posited as learned from, but which can explain failures within medicine (de Feijter et al 2013, Hollnagel et al 2013, Rowley and Waring 2011, Gaba 2004). Simulation has been seen as a good way to teach clinicians about human factors precisely because mistakes do not have their usual consequences:

> mistakes made during simulated exercises do not cause harm to living patients and can be more easily exposed and discussed. Mishaps in the course of learning can thus be reviewed openly without concern of liability, blame, or guilt—even decisions and actions that result in the death of the simulated patient. SBME [simulation-based medical education] can help break the culture of silence and

> denial in medicine and their implications about the learner's competence (Ziv et al 2003, 785).

With respect to how this discussion about mistakes and who defines them is played out in this article: in studying the teaching and learning of human factors, we have attended to the interactions within which this object of knowledge is identified. This implies treating human factors and mistakes methodologically as social constructions, rather than facts existing independently of ways of knowing them. This move contrasts with some of the human factors literature we have read, and accounts we encountered in the field, in which mistakes are cognitive phenomena that are either there or not there, and then either correctly/incorrectly identified (Reason 1990). Our stance reflects our membership of colleague groups who study science and education as ongoing, material, social activities. In the instance of studying how medical mistakes are learned from and about, this stance gives rise to specific ethical questions, pertaining to how researchers position themselves in relation to the researched colleague group. These questions can be explored in relation to two contrasting traditions for studying mistakes in medicine.

The first position encompasses the work of Freidson (1975) and Millman (1976) who developed Hughes' account by showing how medicine was constituted by practices for defending the legitimacy of professional knowledge through contrast with lay knowledge. Millman's study in particular revealed that this led to the systematic denial of error in medicine: 'doctors share many justifications and excuses for making mistakes and for not pointing out each other's incompetence and poor judgment. These justifications are learned in professional training and are supported in the daily practice of medical work. Rationalizations for mistakes and for not criticizing colleagues are encouraged' (10). Millman focuses on medical mortality

review conferences, concluding that these events showed how 'medical practitioners…*neutralise* the *actual* sloppiness and carelessness *made obvious by* [a] mistake' (98 – our italics). The italics identify how Millman, as an ethnographer, identifies mistakes. She treats the interactional denial of error in settings designed to discuss them as pointing to the '*actual*' presence of error within medical practice. This conclusion is reached on the basis of a supposition about ethnographic knowledge: that it reveals what social groups deny or repress, which is the basis of their collective life, and which the ethnographer makes visible through the application of disciplinary knowledge. This move could be said to characterize structuralist sociology, and is indicative of Millman's concern to assert the prerogative of the sociologist to know what others misrecognise (Rancière 1984, Latour 2005).

Millman claims a moral position – and a disciplinary one - by revealing the shortfalls of a powerful profession. This stance has certain similarities, we would argue, with the human factors rationale we experienced in the field, as well as in some of our reading about it. Both treat mistakes as deficiencies of professional/ 'insider' culture, and as essentially objective events. The educational implication of this stance is that those who make mistakes do so because they lack (or deny) knowledge of them, a problem that can be addressed by giving them knowledge.

The second position has emerged in reaction to the first. Bosk (2003, xvi) introduces his study on mistakes in surgery with a critique of his social science colleagues: 'their failure to find social controls, I argued, stemmed from a lack of appreciation of the inherent uncertainty in the everyday practice of medicine, a definition of error that failed to appreciate the 'essentially contested' character of error'. Bosk emphasizes that an event's classification as mistaken changes across time and space, which does not mean that doctors collude in denying mistakes, but rather

that the phenomenon is problematic in its identification. Paget (2004, 24) develops this argument into one about scientific knowledge practices, framing mistakes as intrinsic – rather than extrinsic - to medicine: 'professions have working knowledge, practices that permit them to develop reasoned responses to particular problems and events. Their working practices develop by trial and error. This does not mean that they lack sufficient knowledge (though they sometimes do) nor does it mean that their practitioners are inept or negligent (though they sometimes are). It means that their knowledge/practices are characteristically experimental'. The naming of a mistake is the expression of a wish rather than the identification of a fact: 'the sorrow of mistakes has been expressed as the too-lateness of human understanding as it lies along the continuum of time, and as a wish that it might have been different, both then and now' (149).

These two positions do not emerge from radically different data, but different ways of interpreting the power of professional, and ethnographic, knowledge. Each position has educational implications, the first emphasizing more independent accountability and regulation of competences, the second support with experimentation and lack of mastery in professional/disciplinary practice. These implications are not mutually exclusive (Bosk 2003), but they have different answers to questions about how mistakes arise, are identified, and what is to be learned from them. They have a different way of imagining the relationship between risk and work, and how responsibility is, and can be, claimed or disclaimed (Schepens 2005). This difference highlights that the teaching of and about mistakes is inextricable from the teaching of a morality, the instilling of a collective, professional conscience (Bosk 2003) – what constitutes right and wrong in a professional culture, and what makes up the area in between.

The simulation-based teaching of a human factors rationale is also the teaching of a morality. What we aim to do in this paper is examine how this is taught and in the conclusion consider the ethics of this teaching, on the basis of the above and subsequent debates within ethnography.

The study

Between January and October 2012, Caroline sat in on 30 half or whole day courses at four simulation centres in London. These centres featured 'immersive' or 'high-fidelity' facilities, in which the clinical environment is symbolised, by contrast to particular parts of the body, as with, for instance, surgical simulators (Johnson 2008, Prentice 2005). What we mean by 'simulation centre' then are facilities consisting of beds, monitoring and other medical equipment, cupboards full of drug containers, and mannequins; as well as teaching facilities, such as 'de-briefing' rooms for group discussion, a 'control room' from which a mannequin's settings are manipulated and actions observed behind a one-way mirror, and boxes of props including wigs and make-up. The clinicians doing simulation-based courses were trainee doctors (from Foundation to Registrar level[i]), with sometimes nurses and other health professionals. Courses were attended by 6-12 trainees, and taught by 4-6 faculty members, consisting of senior nurses and doctors. Most courses in the centres, and thus most observed courses, taught about human factors. Observing involved mainly sitting at the back or in control rooms, and writing notes on how teaching and learning happened.

Courses usually consisted of three main elements. First, lectures about the purpose of the course. Second, a sequence of scenarios (between 2 and 6), lasting approximately 15 minutes, and in which 1-2 trainees role-played a situation specified by faculty members. For example, a trainee might be told 'Mrs Smith has been

brought into A&E by her sister. She is complaining of stomach pain, and you are the first doctor to examine her', and then sent into the simulated ward to respond to the prompts controlled by faculty members. Third, and following each scenario, a debriefing, lasting between 20 and 45 minutes, and in which the scenario was discussed. Scenarios were observed by faculty members from a control room, and by the other trainees in the debriefing room via an audio-visual feed consisting of multiple camera angles.

We were given this audio-visual feed in many instances. Its availability is suggestive of the peculiarity of simulation centres as places of medical work, which is subject to being filmed. It is this capability that trainees named in discussing their anxiety about a course; their actions had never been subject to such scrutiny, not least by their peers. This anxiety, and on one occasion a panic attack, qualifies the description of simulation as a 'safe' place to learn. It also raised difficult questions about how to maintain an ethical stance. For example, the terms of consent were agreed with hospitals' research and development offices, where the project was classified as 'low risk' because patients were not involved[ii]; yet the practice of negotiating consent in the field highlighted trainees' and educators' concerns about who would see the data. Our seeking consent thus highlighted the different ways in which the research was interpreted depending on what was considered our object of knowledge: medical or educational practice, and by extension, medical or educational failure.

We have analyzed our data as discursive practices (Hodge and Kress 1988, Potter and Weatherell 1987), using an approach familiar within linguistic ethnography (Copland and Creese 2015, Rampton 2007, Rampton et al 2002, Atkinson 1995), which accounts for cultures in the form of semiotic processes. This enables us to trace

how a curriculum object – human factors – was given meaning in practice. The method involved analyzing how meaning was assigned to words, such as 'mistake' and 'human factors', including how such meanings were maintained and challenged over time. The benefits of this emphasis on concrete, semiotic exchanges is that data can be reported in publications but also discussed with participants, opening up possibilities for interpretation, and making this the basis of reporting back (Iedema 2014, Zuiderent-Jerak et al 2009). One disadvantage is that a focus on discursive patterns in transcript excerpts can make the analysis of the situation rather cursory (Rampton et al 2002). We draw on field notes to keep a bigger picture in the frame. The data we focus on here are drawn from two phases of interactions: the introductory lecture, in which human factors were defined, and the 'de-briefing', specifically exchanges focusing on the identification of human factors. Our aim is thereby to explore how the object of knowledge was defined and interactionally practised. Our analysis indicates that the teaching of negatively valued objects – human factors, mistakes – was realized through the positive evaluation of 'non-technical skills', a pedagogic strategy legitimized on the basis of a claim to 'non-judgmental teaching'. It is this practice that leads us to raise questions about the ethics of simulation-based teaching, and the way in which the historical problem of defining and identifying mistakes at work is addressed within it.

Mapping the relationship between mistakes and work: defining human factors

Courses invariably started with a short lecture about human factors, which trainees usually said they had not heard of. These lectures work as statements of curriculum, identifying what is to be learned and how, and thereby providing a kind of 'interpretative repertoire' (Potter and Wetherell, 1987, 138) by which to characterize

and evaluate actions and events. They suggest how the experience of simulation is given a distinctive form – how it is to be known and regulated (Bernstein 1971). Lectures often involved generic slides, shared across sites and faculty members, with some edits and adaptations. Below are examples, taken from video transcripts, from two lectures in two sites:

> OK, human factors, it's all centred around patient safety, it came from the aviation industry, it came through to us, it centres around patient safety, and the results of human error and what you can potentially do, and mostly, when you look at error, a lot of it is not really down to technical skills, it's down to non-technical skills, which is one portion of error, which we're going to explore a bit more today. But it's essentially things like team working, being an active team worker, leaders, followership, followers, communication. But some of it is cognitive, like decision-making, OK, and prioritising, and those sorts of things. And hopefully you'll get a taste of all of that today as we look at the scenarios. So we're not judging your clinical performance in any way. OK? So don't worry.
> (Video transcript, centre 1)

> Human factors, what do we mean by it? It's about things that affect a person's performance. So that's part of what simulation training is about. It's looking at performances. However, I'd like to stress now that we are not assessing you, we are not looking at how good you are, how many mistakes you make, or whatever. It's about being in a safe environment, being allowed to make mistakes if you like, so that we can all discuss them and we can all learn from them […] Human error is responsible for 70 to 80 %. So it's not machines going wrong, the drugs are wrong, it's all human error. So 70 to 80%. It's something we need to keep in the back of our minds. We are humans, and we do make mistakes. But it's how we can recognise the risks in the situation that we are in. So we mentioned non-technical skills at the beginning, that we need to deal with a crisis, and the sorts of things that we are going to be looking at in each of the scenarios, although they are all different, is how you cooperate, how you lead, are you aware of the situation that you are in and managing that situation, and how you make decisions.
> (Video transcript, centre 2)

What do these excerpts say, firstly, about mistakes in medical work, and, second, about simulation as an occasion on which to learn about them?

First, mistakes are presented as having an identifiable, quantifiable and generalizable root cause, divided into one of two kinds, technical and non-technical, the latter accounting for the majority ('a lot of it is not really down to technical skills, it's down to non-technical skills'). The opposition established between 'the technical' and 'the non-technical' establishes a sharp boundary between them, with weaker boundaries maintained within the 'non-technical', whose units are listed sequentially without apparent order of priority ('it's essentially things like team working, being an active team worker, leaders, followership, followers, communication'). Although this non-technical knowledge is presented as having been imported from a specialist, professional area ('it came from the aviation industry'), its vocabulary is evoked in non-specialist terms ('it's essentially things like…', 'It's about things that affect a person's performance'): in other words, the 'non-technical' is something to be 'schooled' (Bernstein, 1971) – something to be taught – but made up of lay knowledge. Indeed, the naming of mistakes as instances of 'human error' present these as psychological and universal phenomena ('we are humans, and we do make mistakes') manifest in the behavioural, intersubjective dimension of work, by contrast to medicine's technical, scientific knowledge practices ('it's not machines going wrong, the drugs are wrong, it's all human error'). In other words, mistakes in medicine occur primarily by virtue of its activity as experiential, psychological work – its lay, human aspects - which degrade the implementation of largely ('70-80%') correct clinical techniques. 'Non-technical skills' are positive entities, which mitigate human error and enable the recognition of risks, but also, it follows, the primary cause of mistakes.

Second, the pedagogy of simulation is presented as 'non-judgmental', a term that faculty members often used to describe their teaching to us, and to trainees. In these excerpts, this non-judgemental teaching is evoked in phrases including: 'we're not judging your clinical performance in any way. OK? So don't worry'; and 'I'd like to stress now that we are not assessing you'. The non-judgmental teaching of non-technical skills is said to make simulation a safe place to learn ('It's about being in a safe environment, being allowed to make mistakes'). Mistakes made in a simulation are occasions for cooperative talk and the demonstration of what is shared; clinicians' human qualities, as distinct from differentially distributed professional knowledge. This claim marks a shift from positional to personal authority, with knowledge of human factors and non-technical skills arising in/as bonding and solidarity with trainees ('we can all discuss them and we can all learn from them'). The tension between the claim to teach 'schooled' knowledge and to do so non-judgmentally is evident in the shifts between the 'we's' and the 'you's' in the extracts above: 'it came through to us… what you can potentially do…'; 'we are humans….we are going to be looking at […] how you cooperate…'. In other words, the faculty members here claim pedagogic authority on what is to count as relevant knowledge, but disclaim the professional authority to do so on the basis of their hierarchical position.

This account of mistakes contrasts with earlier studies of mistakes in medicine that present them as occasions for the exercise of professional authority, and for the differentiation of expert from lay knowledge (Hughes 2011, Bosk 2003, Atkinson 1997, Millman 1976, Freidson 1975). For example, whereas Atkinson (1997) depicts bedside teaching as an occasion for the correction of students' mistakes by means of the display of senior doctors' clinical knowledge, here, such embodied knowledge is undercut by its association with the lay quality of 'human error'. This formulation of

the relationship between mistakes and work resonates with recent qualitative and ethnographic studies that identify the 'deficiency model' of safety (Zuiderent-Jerak 2009) introduced to healthcare organisations over the last 10 years, with its emphasis on devising effective systems of care delivery which 'build-in' safety as a non-human, scientific property, to counteract the interests of self-serving hierarchies (Iedema 2009, Rowley and Waring 2011, Waring 2009).

The benefits of the human factors model of error were described to us in terms of challenging the culture of blame in medicine, and the unjust exercise of hierarchical authority that underpins it. Faculty members emphasised that it was important to bring about a culture change in medicine, so that trainees felt able to challenge the actions of seniors and point out their human errors. The legitimacy of this argument was claimed on the basis of the safety records of other industries – notably aviation - which were said to be less hierarchical, and more concerned with protecting the safety of its customers than the authority of senior professionals (thereby establishing an opposition between these two aspects of work).

However, despite its novelty, there are also continuities between the rationale presented in lectures and earlier accounts of mistakes in medicine. Bosk (2003) identifies four ways in which surgeons account for mistakes: these are either technical, judgemental, normative or quasi-normative. Whereas the first two are treated as features of the training situation, the latter two are treated as breaches of a norm and occasion for corrective remedies. This difference is reinscribed in the technical/non-technical distinction, in treating transgressions of the hospital's social order as more significant than clinical/technical shortcomings. Bosk, Hughes and Millman also all note how senior doctors claim medical mistakes as events that can happen to anyone. Bosk (145) describes this as the ritual of 'putting on the hair-shirt',

part of medicine's 'chivalrous code of behaviour', by which the admission of failure emphasises the speaker's humanity, wisdom and awareness of the formidable task facing him. This understanding of mistakes is echoed in the rationale that doctors make mistakes because they are humans working in crisis situations.

These continuities may explain the appropriation of some aspects of the human factors rationale from its ergonomics and engineering literature, as well as the neglect of other aspects. Our reading about human factors suggest that the field is constituted by debates about whether mistakes have identifiable, distinct and repeatable causes or are unfortunate combinations of events (Hollnagel et al 2013, Hollnagel and Leonhardt 2013, Woods and Hollnagel 2006), whether mistakes can be counted and identified independently of the socio-political circumstances in which they occur (Wallace and Ross 2006), whether the disaggregation of work into discrete elements such as non-technical skills has validity (Dejours 2008, Dekker 2005, 2006) and whether mistakes are to be understood on the basis of methods from experimental psychology or ethnography (Hollnagel et al 2013, Dekker 2005). We are not the first to identify the selectivity of the human factors rationale in medicine (Russ et al 2013, Hollnagel et al 2013), but this selection might be interpreted in terms of a professional history of accounting for mistakes rather than a negligent reading of the literature.

Re-classification: teaching non-technical skills non-judgementally

Despite the attention given to human error in lectures, errors were rarely identified in de-briefing discussions. This characteristic of simulation-based medical teaching has been noted in clinical literature, and critiqued. Rudolph et al (2007, 369), for example, reflect on their early experiences of simulation-based teaching and state: 'we were saying that mistakes were discussable and a source of learning, yet we found that we tended to cover them up or shy away from discussing them'. They attribute this to the

desire of ‘avoiding negative emotions and defensiveness, preserving social face, and maintaining trust and psychological safety’, which led them to ‘obscure their expert critique’ (368).

Our participants did not treat the dearth of identified mistakes as problematic, but rather as indicative of what they were endeavouring to teach: human factors and/as non-technical skills, rather than expert/technical knowledge.

Our transcripts of de-briefing discussions demonstrate multiple discursive strategies by which teaching ‘non-judgementally’ was performed, including the distributed narration of the scenario’s events, the recruitment of de-briefing ‘models’ adapted from aviation or the army, and the practice of multi-professional team teaching. We will focus here on only one discursive strategy, however, which pertains to the teaching of human factors and/as non-technical skills. What interests us about it is how it resolves the difficulty of identifying and teaching skills defined as lay, by contrast to professional; and how it occurred commonly in response to trainees’ identification of their own mistakes (and other trainees’ mistakes, which however rarely happened). We called it ‘re-classification’ because it involves re-categorising trainees’ descriptions as instances of non-technical skills. The following exchange illustrates it, taken from a debrief in which the trainee referred repeatedly to his failure to diagnose post-operative bleeding sufficiently quickly:

Participating trainee	She said do you want me to bring the crash trolley and I went yes please and she brought the crash trolley (.) then I think you finished your phone call (.) then the cardiology reg called (.) then everything else kind of happened ↑it all seemed to happen very quickly to be honest (.) the whole thing (mumbles)
Faculty member	You had early] recognition that things were < not quite what you wanted > and (.5) I I think because you had experienced (.2) an experienced nurse with you you worked quite well together […] you were lucky cos you had an experienced nurse with you but you were talking all the time and so she was aware of all your thought processes all the time which meant that the situation that was unfolding in front of you was being (.2) you know you were

> sharing the mental model although <you weren't quite together> but I thought you showed quite good democratic leadership you realised who had the skills (.2) for what and allocated the tasks
> (video transcript, centre 1)

The trainee's account breathlessly evokes paralysis in the face of a rapidly evolving situation: parataxis (Hodge and Kress 1988) conveys an emphasis on the situation experienced moment-by-moment, with events retold as happening in parallel or in sequence but with no logical order. By contrast, hypotaxis characterizes the faculty member's account, by which events are subordinated to one another in a logical order and causation links established. In other words, where the trainee identifies disorder, the trainer establishes order. The effect is that non-technical skills are made sensible; they appear in the scenario by means of the faculty member's intervention and transformation of the trainee's account. The slowing down of speech is indicative of 'problematic talk' (Copland 2011); the faculty member here is not however merely being polite about actions not being 'quite together', as a simple application of politeness theory might suggest, but rather describes what 'sharing the mental model' looks like, through an account of it – and one which contrasts with the trainee's account. The faculty member's intervention includes instances of 'positive jewelry' (White, in Copland 2011), which minimize certain criticisms – for instance, the characterizing of 'democratic leadership' which is however attributed to the luck of having 'an experienced nurse' – but this does not simply make the feedback polite, as in Copland (2011), but rather demonstrates a curriculum objective (leadership as a human factor). The trainee's account, which here and elsewhere in the discussion identify limitations, is thereby corrected and re-classified as an instance of non-technical skills.

Here is another example:

> Participating trainee I think the things I know I notice this in myself in my

	clinical practice is my (.) I come up with a clear plan and can't communicate it without (.) I sort of chop and change a lot
Faculty member 1	You were very clear first you wanted [this
Participating trainee	Yes], and then I wanted that
Faculty member 1	And then you changed your tack […]
Participating trainee	And then quite early on I had to have a quite grumpy conversation with someone on the phone (.) I was probably a bit rude, and I do apologise for that […]
Faculty member 2	And you were very succinct in stating he's sick we haven't done anything we are resuscitating and he's not going to go anywhere so I think that was really good
Faculty member 1	I think you were really clear I think you were assertive

(video transcript, centre 2)

Again, the trainee's account identifies limitations - 'I sort of chop and change a lot' – which are then re-classified as positive instances of what is to be taught (the communication skills identified in the phrase 'You were very clear'). The subsequent apology contradicts the faculty members' positive evaluations, suggesting a moderated rejection of the compliments being offered. This leads to further praise, the effect of which is to identify the manifestation of non-technical skills. Disagreement with the trainee's account is thereby realized as collegial solidarity.

The practice of re-classification enabled faculty members to identify non-technical skills as already present in the actions of trainees: the lay skills to be taught were not so much absent as unrecognized. Teaching non-technical skills thus involved teaching a vocabulary to describe skills which trainees were posited as already exercising without being aware of doing so. This discursive strategy is indicative of the meaning of 'non-judgmental teaching' in this context, reconciling the teaching of schooled knowledge whilst disclaiming professional authority and hierarchical difference.

Trainees' negative judgment of their own performance appeared symptomatic of the anxiety they usually showed at the start of courses; it pre-empted criticism, neutralizing this through a display of professional conscience. Faculty members'

positive evaluations of trainees' performance communicated that trainees' anxiety was a worthy form of self-surveillance, but that there were also limits to the proper expression of guilt, since mistakes were human. This pattern of interaction repeats one described by Bosk (2003), who states that a doctor's public confession of a failing normally calls forth unconditional professional support, since admission is treated as sufficient condemnation in itself and proof of the doctor's dedication to patient care. A major difference with Bosk's study is that the display of one's errors was, in his site, a privilege of senior staff. In our study, the confession of failings was not a privilege of rank insofar as it was called forth by a statement of universality (although of course faculty members never performed scenarios for de-briefing by trainees). However, faculty members' re-classification of failings into non-technical skills maintained the exclusive authority of professional hierarchy to discriminate mistakes from the proper exercise of work.

This authority was not unquestioned. In identifying their own failings, trainees' invariably also pointed to those of the course, naming the ways in which a scenario was unrealistic and misleading. These claims countered faculty members' efforts to teach non-technical skills, by focusing instead on the limitations of the technology and the circumstances of its use. In reclassifying trainees' accounts as demonstrations of non-technical skills, faculty members also upheld the legitimacy of simulation as a method of teaching, and human factors as its object of knowledge.

Talking about a mistake

Although most of the de-briefing discussions we observed were oriented towards consensus and the identification of non-technical skills, a small number – 5 of which 3 we have analysed in detail – broke this pattern. These cases were characterized by

disagreements about how the scenario could be described and by subsequent discussion among faculty members that the de-briefing had been problematic and/or that the scenario needed revising. The cases offer insight into what was deemed undesirable by faculty members: what was in need of some kind of repair, to avoid problematic de-briefings in future.

Below is an extract from one of these discussions, taken from a short period before the de-brief was formally inaugurated by the usual initiating question 'What happened?'. The scenario had been performed by a trainee who was described by faculty members - in the control room - as having mis-diagnosed anaphylaxis, confusing this for acute transfusion reaction[iii]. Having treated the manikin for anaphylaxis initially, the trainee changed his treatment in the last couple of minutes of the scenario, after faculty members had provided additional clues to help him make their intended diagnosis.

	((Trainees re-enter the de-brief room. Brief applause followed by 53 second silence))
Faculty member	So if I wasn't here would you all be chatting? ((laughter)) I can pop out if you like ((laughter)) (mumbles)
	(10s)
Trainee 7[iv]	((to Participating Doctor, on the other side of the room)) How are you feeling over there
Participating trainee	↑Yeah↑a little bit edgy ((laughter)) oh dear↓
Trainee 7	It does feel real doesn't it
Participating trainee	It does and because you know it's a scenario you are waiting for the car crash↑ ((laughter)) it's not =
Faculty member	= and that is one of the failures =
Participating trainee	= and it's not quite realistic in terms of like the patient is slumping you are always like expecting them to be dead ((one trainee laughs)) and unless she says ((pointing to his neighbour, Participating Nurse)) 'hello, are you still with us' then you can't really tell so I'm always a bit 'OK is it crash time ((he laughs, others too))
Faculty member 1	= One of the major failings of this kind of stuff is that we do pick up an enormous amount of information just from glancing about =
Participating trainee	= mmm
Faculty member 1	You lose a load of that (.) Just how people are moving or how people are reacting to you or how awake they are or not (.) just just by looking at them or indeed skin tone all that sort of stuff (.) And

	yes, that is a problem and yes one one of these days I'm just going to put someone through a complete normal scenario just to really fuck you up ((laughter)) Just to watch you sit there 'something is going to go wrong' ((rocks back and forth on his chair, feigning anxiety)) Just have it as you just have to sit there and chat to the patient (.) that is going to be awesome ((laughter - then 4 second silence))
Trainee 7	Have there been any (.) thoughts on how (.) to make sort of surprise situations 'cos these things happen when you are least expecting it say when you are having a bad day when you are tired or hungry (.)
Faculty member 1	Well ↑occasionally [erm
Trainee 7	[Not when] you are [like ((puts both hands up, feigning terror))

The faculty member interrupts the long silence by identifying his outsider status from the group of trainees, laughter pointing to the delicacy of the situation and marking the question as affective rather than literal. None of the trainees take up the offer of a humorous turn. Instead, concern is expressed about the participating trainee's feelings, a move which offers solidarity with him, the 'over there' arguably a marker of his (distant) symbolic position in the professional group rather than his literal place around the (not very large) table. The rising intonation in the participating trainee's response frames it as a question, casting doubt on the accuracy of the 'yeah', with the laughter, falling intonation and 'oh dear' identifying whilst minimizing a delicate situation. The subsequent exchange marks feelings as real even as the situation from which they emerge is said to be unreal, with the participating trainee identifying how the situation of simulation itself leads to misdiagnosis ('you are waiting for the car crash', i.e. on a course about the management of medical emergencies, one is waiting for a medical emergency to happen, notably curriculum standards such as cardiac arrest) – a claim which undermines the authority of the 'fake' pedagogic situation by its contrast with 'real' clinical practice. The faculty member expresses solidarity through agreement about the limitations/failings of simulation ('*we* do pick up an enormous amount of information'), and an account of the un-simulated complexity of 'real' clinical practice. This move, we would argue, is

an endeavour to re-establish solidarity with the group of trainees on the basis of an acknowledgement of shared 'real' clinical capability, the professional bond having been identified as broken from his first intervention and Trainee 7's subsequent turn. The faculty member's humourous acknowledgement of the non-reciprocity of simulation as well as the use of an informal register ('just to really fuck you up') offers symbolic intimacy and social solidarity, one which again is not taken up by trainees (as shown in the 4-second silence). Trainee 7's penultimate intervention develops the critique of the validity of simulation as well as its ethics of safety, the faculty member's moderated disagreement interrupted, solidarity thereby again rejected, and pedagogic authority refused.

The excerpt illustrates how the perception of error threatened both professional solidarity and pedagogic authority. What is practised discursively here is a marking of insider and outsider status, by means of exchanges on the nature and reason for error, and the identification of failure in the pedagogic situation itself. In the subsequent elaboration of the de-briefing discussion, faculty members focused on the identification of the participating trainees' non-technical skills, a move which marginalized complaints about the pedagogic situation, re-established the authority of faculty members in initiating questions and giving evaluations, and re-established agreement within the group to some degree (the participating trainee however remained attentive to the limitations of the simulation throughout, and also visibly distressed).

We have discussed this excerpt at data sessions with several of our study participants, with the aim of exploring the affective aspects of simulation-based teaching, and the problematic consequences, as we see them, of how error is defined as an aspect of lay, 'human' qualities identifiable through non-judgmental teaching.

On some occasions, the faculty member's actions have been extensively criticized for sacrificing the validity of simulation on the altar of professional solidarity. The criticism assumes that a mistake was made by the trainee that warranted correction; it thereby disqualifies the objections to this assessment in the excerpt itself and insists on faculty's pedagogic authority. A contrasting reading has been that the data reveal the 'real' educational weakness of simulation; this reading has been offered to us by clinicians who do not teach in simulation centres and express some skepticism about their educational merits on the basis of a lack of realism. This view assumes that the barrier to identifying and learning from mistakes is the realism of their representation; in other words, consensus on how mistakes are to be represented.

Both positions treat mistakes as objectively 'out there', subject to agreement and therefore group solidarity. This is also the assumption at play in the human factors rationale taught in introductory lectures, which makes 'human factors' and 'non-judgmental teaching' the basis of such solidarity. A third position is however opened up by ethnographic research on the 'essentially contested' quality of mistakes at work.

The ethics of teaching about medical mistakes through simulation

The main argument for simulation's educational and ethical imperative is that it provides a safe place to learn from mistakes, by contrast to the workplace (CMO 2008, Ziv et al 2003). In our study, this imperative was inextricably intertwined with the teaching of a new rationale to explain medical mistakes – human factors – and its associated pedagogic strategy, non-judgemental teaching. Both were intended to make mistakes into phenomena which could be learned from.

We have shown that the teaching of human factors in simulation centres does not so much mean that mistakes can be made safely, but rather that they cannot be

made: accounts of practice, including identified failures, are re-classified as demonstrations of non-technical skills, a move which maintains the basis of professional solidarity on an absence of mistakes. The right to identify a mistake is usurped by the claim to knowing non-technical skills, and knowing these in lay, human qualities, by contrast to differentially distributed professional/technical knowledge.

The value of the human factors rationale was justified in our sites in terms of challenging the culture of medicine, including its culture of blame, shame and denial. The positing of this culture implies that mistakes are made and then covered up. This is the story that Millman (1976) also tells, when she describes how doctors ignore each other's mistakes, with trainees socialized into the deployment of justificatory narratives to cover up incompetence. The contemporary re-appearance of this narrative logic within simulation-based medical education – by contrast to outside it, in 1970s sociology – points to the disagreements and contestations now taking place within healthcare, as opposed to between medicine and external disciplinary knowledge. These disagreements are however transformed pedagogically, in the simulation-based teaching situation, into a celebration of non-technical skills, in an effort to be non-judgmental.

However, the ethics of this narrative, in which mistakes are equated with a deficit in (albeit lay) knowledge, can be contrasted with its opposing ethnographic narrative, which highlights the 'essentially contested' quality of mistakes in professional practice (Bosk 2003); contested not because they are denied primarily, but because they are problematic in their identification (Paget 2004). The ethics of this narrative are claimed on the basis of seeing mistakes from the point of view of those in whose work they appear, as a retrospective judgment on an uncertain,

continuously evolving and experimental professional practice. Medical culture is not figured, in this narrative, as denying mistakes; it can however deny that mistakes are intrinsic to its practice, part of doing healthcare rather than its removeable excess – not because doctors are human, but because medicine is an emerging, practical activity. Paget's argument, in particular, undoes the necessity of equating medical professionalism with the absence of mistakes. Indeed, what Paget and Bosk both teach is that the identification of mistakes is an affective exercise in moral, professional judgment. It is not independent of, and prior to, participation in medical practice, as the notion of a non-judgmental pedagogy implies, but intrinsic to it. Their studies, in this respect, highlight that mistakes have long been a concern in medical culture – by contrast to arguments that state they have not. They also suggest that the problem which mistakes pose for medicine is not so much patients being harmed, as what this symbolizes: the experience of a loss of mastery over a recalcitrant object of knowledge.

To point to the indeterminacy of medical work is not to advocate passivity in the face of intrinsic failure, but it does give a different basis for an ethical, educational practice: one which identifies mistakes and the proper execution of work as intertwined, necessary to each other - rather than springing from different sources; one which treats the right to identify mistakes and their remedy as a process within medical education, rather than its a priori; and one which foregrounds experimentation and lack of mastery in professional practice rather than denying this through a positing of technical and scientific perfectibility.

If we draw on this second ethical stance to consider educational practice in simulation centres, what we see is that group discussions in which the identification of mistakes generated contestation and disagreement could be might be considered

productive, potentially, rather than failing, in foregrounding the problem of identifying a mistake, by contrast to assuming it as an inadequacy or deficiency. In other words, such group discussions might be considered the basis of a future educational, ethical practice which explores different moral, professional frameworks for judging failure and responding to it, making the right to identify a mistake into a subject of discussion rather than inherent to a position within a hierarchy (we develop this point in Pelletier and Kneebone 2015, in press). Such a stance aligns with the endeavor to uncouple moral authority from professional hierarchy without simply re-coupling it with the pedagogic hierarchy inscribed in the positive evaluation on non-technical skills.

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i Doctors are classified as trainees when they are following a training programme subsequent to their medical degree. During this training period, they work as doctors, but also engage in structured and compulsory training.

ii This definition of the level of risk was taken from the system of categorisation employed within hospitals to classify types of medical research.

iii Anaphylaxis is an allergic reaction. Acute transfusion reaction is a reaction to blood transfusion, caused by blood group incompatibility.

iv 'Trainee 7' refers to the position of the trainee around the table in the de-brief room.