Improving Clinical Communication: A View from Psychology

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Improving clinical communication: a view from psychology

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Abstract

Recent research has studied the communication behaviours of clinical hospital workers and observed a tendency for these workers to use communication behaviours that were often inefficient. Workers were observed to favour synchronous forms of communication, such as telephone calls and chance face-to-face meetings with colleagues, even when these channels were not effective. Synchronous communications also contribute to a highly interruptive working environment, increasing the potential for clinical errors to be made. This paper reviews these findings from a cognitive psychological perspective, focusing upon current understandings of how human memory functions, and upon the potential consequences of interruptions upon the ability to work effectively. It concludes by discussing possible communication technology interventions that could be introduced to improve the clinical communications environment, and suggests directions for future research.

Keywords

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Introduction

Communication between healthcare workers accounts for the major part of the information flow in health care, and growing evidence indicates that errors in communication give rise to substantial clinical morbidity and mortality[1]. Covel[2] has reported that about 50% of information requests by clinicians in clinic were met by colleagues rather than documented sources. Safran et al.[3] reviewed the information transactions in a hospital with a mature computer-based record system, and still found about 50% of information transactions occurred face-to-face between colleagues, with email and voicemail accounting for about another quarter of the total. Given the importance of interpersonal communication as a means of information exchange, it is not surprising that communication failures are a large contributor to adverse clinical events and outcomes. In a retrospective review of 16,000 in-hospital deaths, communication errors were found to be the lead cause, twice as frequent as errors due to inadequate clinical skill[4]. Further, about 50% of all adverse events detected in a study of primary care physicians were associated with communication difficulties[5].

The causes and remedies of poor communication within the healthcare system are consequently of critical interest to the study of informatics. Much work has been done examining the dynamics of the communication between individual healthcare providers and patients, and as a result a body of work exists which can help optimise that interaction[6-9]. Similarly, bodies of work exists on nurse-physician perceptions of and satisfaction with their communication[10-14] and on physician teaching behaviours[15-18].

However, there is a paucity of detailed data about the effect of communication behaviours on overall organisational efficiency and effectiveness in healthcare. There have been some studies which have investigated the use of communications technologies in healthcare settings. One study in a nursing home found that the number of telephone calls nurses received constituted a significant communication burden, and that most calls were routine or informative only[19]. Introduction of a voicemail system allowed the vast majority of calls to be transferred that medium, saving both time and unnecessary extra communications.

Spurck et al.[20] found that nurses and physicians felt their hospital's telecommunications system was more effective when nurses were given portable phones to carry, and noted several efficiency gains. Another study looked at the effects of voicemail on internal and external customer satisfaction[21]. None of these studies, however, explores the basis for individual communication choices or the cumulative effect of those choices on clinical teams or the wider organisation. An exception is a study by Coiera and Tombs[22] who observed that the communication behaviours of individuals in hospital teams are often individually inefficient or unsuccessful, and when taken as a whole, result in an interrupt-driven environment within the organisation.

There are a large number of factors that might influence communication behaviour within organisations, including the nature of the available communication infrastructure, the nature of the work undertaken, and the practices that are routinely applied within the organisation by individuals. A limiting factor in any communication analysis is the cognitive capacity of

individuals to undertake their work, and in studies of high cognitive workload, it has often been shown that error or inefficiency results when cognitive limits are exceeded[23].

In this paper, we focus upon the cognitive limits of individuals and how these might explain the inefficient and interruptive clinical environment characterised in the Coiera and Tombs study. We do so by drawing together the available clinical findings with empirical research from cognitive psychology. In particular, we are interested in human memory, as we speculate that the burden on memory that results from a highly pressured working environment is a significant contributor to the interruptive behaviours observed.

By adopting this approach, we hope to achieve several goals. Our first goal is to provide a principled framework within which existing findings about communication patterns in healthcare organisations can be understood and direct further research. Our second goal is to promote an understanding, based upon empirical psychological research, of the sorts of problems in real working environments that can potentially be addressed by the appropriate application of new communication technologies.

In addition, in discussing the social environment into which new communication technologies are introduced, we aim to caution against an approach that does not make the social environment the object of study. Enthusiastic applications of new technologies do not always have the consequences expected of them. This is not least of all because they are always introduced into a social environment, and this often acts strongly to modify the ways in which their capabilities are harnessed.
Finally, we hope to stimulate psychologically and sociologically informed research into the effective application of new communication technologies to hospitals.

In the next sections, we introduce relevant concepts from cognitive psychology and then relate these to the existing clinical communication findings. In particular, we discuss specific types of memory error that are likely to be seen in interrupt-driven environments. We then use this model to discuss the likely consequences of introducing different communication technologies into this environment.

Clinical communication patterns

Coiera and Tombs[22] observed the communication patterns of eight physicians and two nurses in an English district general hospital. The available channels of communication for these highly mobile professionals consisted of face-to-face meetings, both impromptu and planned, desktop telephones, paging, written notes for colleagues in patient notes, notes at ward desks, notice boards and pigeon holes for personal memos. Voicemail and email were not supported, and mobile telephones were not used. In common with other studies, the subjects in this study made little or no use of more formal sources of information, with the exception of data from the medical record.

One of the communication behaviours observed was a bias towards interruptive communication. Interruptive, or *synchronous*, communication methods are those which require the simultaneous

interaction of the two parties to the communication: the telephone and face-to-face discussions are two such methods. By contrast, an *asynchronous* method, such as writing a note or leaving a voicemail or answer phone message, allows the recipient to deal with the communication at a time of his or her choosing. The authors reported that staff showed strong preferences for making telephone calls, and for taking advantage of chance face-to-face meetings with colleagues. There was little evidence that staff's own experience of interruptions encouraged them to adopt more 'considerate' communication methods when contacting their colleagues. The authors also observed that the reliance upon synchronous methods can be a source of inefficiency for the person attempting to communicate. Recipients may be unavailable or occupied, or the communication channel may be busy, and tasks remain undone until these conditions change.

Coiera and Tombs' observations are of interest from a psychological perspective for two reasons. First, cognitive psychology may offer explanations for reliance on synchronous communication. Second, the interrupt-driven nature of the hospital work may foster conditions that are likely to result in impairments to memory during the working day, which potentially contribute to clinical errors. In both cases, the application of psychological theory will allow future observational studies to be designed that specifically investigate the bias to synchronous communications, and whether and under what circumstances the postulated memory impairments occur. We therefore introduce in brief some of the relevant concepts from cognitive psychology and discuss how these concepts might apply in this environment.

Human Memory

A knowledge of the way in which human memory is believed to function is key to understanding the probable effects of working in an interrupt-driven environment. It is also key to understanding the requirements of technologies which might be introduced to support those in such environments.

The functioning of human memory has been the subject of empirical study within cognitive psychology for many decades[24]. A basic division of memory into short and long term functional components provides the cornerstone upon which the working of memory is understood.

Our knowledge is believed to be stored in notional 'repositories' known as long term memory (LTM). Remembering medical facts, significant dates, events from childhood and how to drive a car all draw upon long term memory. Much of the time, most of our fund of knowledge and meaning in LTM is inactive; that is, it is not the current focus of attention. Working memory (WM) is believed to be the activated state of information held in memory. It may be equated with the component of memory we associate with attention. WM actively processes information, whether the information is sensory input (for example sounds, sensations or sights currently being experienced) or items from long term memory. When carrying out a mental calculation, making a plan to do something, recalling a phone number or writing a note, it is WM which allows the various 'pieces' of information involved to be attended to, integrated and manipulated.

Working memory has some interesting characteristics. In particular, it is extremely limited in its capabilities. The number of items - such as thoughts, sensory impressions and plans - that can be held in WM is very small[25,26]. Further, items in WM are easily disturbed by each other. This is particularly the case when someone is distracted from thinking about one task by a new one which supervenes. An intention to carry out an act can be forgotten by the intrusion of another plan even when only ten seconds separates the intention from the intrusion[27].

Working memory is also severely limited in duration. Without conscious attention to plans or other items in WM, their accurate memory persists no longer than about 20 seconds. This decay can be overcome by acts of conscious self-reminder: these serve to refresh and reprioritise the items in WM. If there are competing demands upon WM however, such as the execution of another task, or communicating with a co-worker, then such rehearsal of intention becomes impossible, with the same end effect: a plan may be forgotten. Considerable empirical evidence exists which demonstrates the powerful negative effects of both interference and diversion of attention[28,29] upon WM.

The characteristics of the process of forgetting are not random: in particular, two serial position effects, known as the primacy and the recency effects are known to affect retention in systematic ways. The *primacy effect* describes the tendency for superior recall of items longest in WM; the *recency effect* describes a similar superiority of items most recently added to WM. The combined result of these two effects is poor retention of items in the middle of the 'mental list'. In addition, a distracting task before recall can obliterate the recency effect while not affecting the primacy effect[30].

A further distinction may be drawn within LTM between retrospective memory and prospective memory[31]. Retrospective memory refers to the factual, autobiographical and 'how-to' knowledge we possess. Prospective memory, by contrast, is the memory for a future act, or the memory to remember to do something. It necessarily draws upon retrospective memory, and entails complex planning and co-ordination. Like retrospective memory, prospective memory relies upon WM for its processing work. For example, in remembering that you need to contact someone later in the day, you draw upon your retrospective memory in deciding how to make the contact.

The failures of working memory in an interrupt-driven environment

Those who work in an interrupt-driven environment are likely to suffer failures of WM. As interruptions occur, interfering with the active cognitive rehearsal of what is to be done, and generating new tasks for their recipients, prospective plans may be partly or fully forgotten. They may or may not be recalled subsequently, depending upon appropriate cues for recall. The effect will be exacerbated the greater the number of such plans there are. Since planning for prospective activities is an activity of WM, which is limited in the number of distinct items it can retain, then forcing more items into WM will cause some plans to be displaced from it, perhaps to be forgotten. The tasks which should suffer most from interruptions are all but the oldest tasks in a nurse's or doctor's mental 'to do' list.

Coiera and Tombs proposed that immediate acknowledgement of a message seemed to be needed in such an interruptive environment to permit workers to complete a task. Good psychological reasons may be advanced for this, and for the 'selfish' behaviour observed. When a worker's WM is operating to capacity, the highest priority is likely to become the reduction of this mental burden by completing the tasks which are consuming memory resources. Reinforcing this, it is probable that when the consequences of errors can be so serious, it is difficult for a doctor or nurse to feel that he or she has truly 'handed over' responsibility for a task without an explicit acknowledgement from the recipient. Existing asynchronous methods of communication, such as hand-written notes, voicemail and email do not easily or routinely offer this feature. The consequence may be that the task cannot be removed from WM.

Errors of reality monitoring and temporal association

Two further types of memory error may be made more likely by interruptive working environments.

'Reality monitoring' is a term given to the ability to discriminate between 'true' and 'false' memories[32]. True memories are memories of events, objects and actions that really occurred or were experienced. False memories derive from the imagination that something occurred or was experienced. Confusion between the two is a quite ordinary occurrence. It may be seen as a consequence of the way in which memory functions as creatively constructed representations, rather than simple records of sensory information. Childhood memories, for example, are often a composite of the original experience interwoven with what other people said about it and the embroideries that are overlaid on the original fabric as the experience is mentally revisited over time.

Reality monitoring errors may be either omissive or repetitive. If the memory of an intention to act is confused as a memory of having acted, an error of omission will occur. If the memory of the performed act is mistaken as the memory of a plan to act, the error will be one of repetition. For example, if an intention to take a dose of medicine is confused as the action of having done so, a dose will be missed. If the action is mistaken as the intention, an extra dose will be taken.

The second type of errors are those of 'temporal association'. These errors are thought to be strongly associated with routine and frequently performed actions[33]. The more an action is repetitive and routine, the more difficult it can be to decide whether a memory of the action is today's or yesterday's memory. For example, did I really clean my teeth this morning, or am I remembering cleaning my teeth yesterday morning?

Reality monitoring and temporal association errors can therefore both result in tasks being omitted or repeated. Given they are fundamental tendencies of the memory system, we may expect that they may be additional sources of memory failure in an interruptive working environment. These errors will be especially likely under particular circumstances. Outstanding tasks that are simple, routine and repetitive are particularly vulnerable. Under conditions of high work pressure, when there is insufficient time to perform a reality check, errors may be more readily accepted. Further, since junior doctors, like nurses, are required to undertake many more

routine and repetitive tasks than are senior doctors (for example, ordering laboratory tests and securing ward beds for new admissions), it is probable that they are more vulnerable to failures of reality monitoring and temporal association than are senior doctors.

The effects of expertise upon memory

There is a large body of research on the effects of skill acquisition upon problem solving and memory[29,34-36] which indicates that with experience, some components of tasks can be performed automatically. They are sufficiently well learned that once set in train they do not rely on WM in order to be enacted, thereby freeing components of WM for alternative use.

This means that the probability of a memory error is greater for less experienced members of staff. Junior medical officers, for example, are novices in the practice of any given speciality of hospital medicine. As the tasks associated with each level of seniority differ, this will also be true of newly appointed specialist medical staff.

Since experts need to rely less upon general attentional resources than do novices, it is probable that more experienced doctors at every level of the hierarchy, as well as nurses and other healthcare professionals, will suffer less from the effects of interruptions in the performance of specific tasks than will their less experienced colleagues. In the Coiera and Tombs study, the greatest communication burden actually fell upon the most junior staff, whom one would expect to be the group most likely to make errors in such circumstances.

Discussion

New communications technologies

Coiera and Tombs observed two main contributors to the interrupt-driven nature of the hospital environment: the behaviours of hospital workers and the characteristics of the work itself. The work is highly mobile, conducted in multidisciplinary teams, and involves many simultaneous tasks and responsibilities. The existing communications environment in the hospital in which the study took place relied largely on synchronous communications, and did not support mobility. Individuals responded to these factors by favouring synchronous communications even when they were not necessary or even productive, thus increasing the interruptiveness of the working environment.

The previous exploration of memory functioning demonstrates that working in a busy and interrupt-driven environment can over-extend the capabilities of the human cognitive system. In such an environment, there is a premium on immediate task completion and reliance on synchronous communications. Such behaviours permit ambiguities and uncertainties to be dealt with on the spot, and can thus be construed as reasonable adaptations to working in such an environment.

Coiera and Tombs suggested technologies that could reduce the interrupt-driven nature of hospital work. Portable telephones could support mobility, and asynchronous communications technologies such as voicemail and email, with acknowledgements, could fulfil the initiator's need for immediate task completion, while not generating an interrupt for the recipient.

The introduction of new technologies seldom however, permits such straightforward predictions to be made.

Social influence approaches[37-40] to studying information technology have demonstrated that the use of new technologies is not predicted solely by the characteristics of the technologies themselves. Instead the human environment into which they are introduced is critical in shaping how their capabilities are actually used. Attitudes of key individuals and organisational norms are amongst the important factors which shape adoption and use[39].

There are thus many uncertainties about the actual use of technologies. Correspondingly, this is a fertile area for research, no less in the medical field than the world of the office. In the following sections, some of the difficulties with these simple predictions about introducing new technologies are explored, to underline the difficulties that unexpectedly arise when apparently simple solutions are introduced into complex human work environments.

Increasing interruption and the bias to synchronous communication

What might be achieved by providing staff with mobile phones? The general effect of introducing mobile phones is to make individuals more available[20]. Since failure to reach individuals results in further attempts to make contact, mobile phones would be expected to reduce the call failure rate and thus reduce the overall call traffic for the organisation. For the individual caller, it could mean a reduction of the number of outstanding tasks as call recipients become more readily obtainable. This means the corresponding number of items in working memory associated with that task no longer compete for attention.

For the recipient, however, the picture is less clear. If providing mobile phones only reduces the number of call re-tries, we would expect interruption levels to be unchanged. However, if the ease of contacting individuals has the effect of creating additional calls for conversations that would not have occurred previously, then the overall interruption level would increase. We would predict in these circumstances that each new call generates an interruption, and an addition to WM.

The synchronous bias hypothesis[22] predicts that individuals preferentially use synchronous communication channels. Mobile telephones, by making synchronous communication easier, would thus be predicted to result in new calls being made, and consequently result in an increase in the overall interruption rate for individuals.

In such circumstances, new synchronous technologies therefore would not, on their own, resolve the practical or the cognitive difficulties faced by those in interruptive working environments.

Asynchronous messaging

What might the provision of asynchronous technologies mean? The technology would permit the message sender to achieve task completion independently of the recipient's location and current activity. The recipient may choose a convenient time to consult and act upon his or her messages.

The cognitive benefits of voicemail and email for both message senders and recipients could be substantial. For callers, independent completion of communication tasks reduces the number of pending tasks in WM. For call recipients, the receipt of fewer interruptive calls would be likely to contribute to greater chunks of uninterrupted time and greater ability to rehearse and recall existing outstanding tasks. It would allow more tasks to be completed, fewer errors in task completion, and fewer forgotten tasks. These probable benefits from moving some communication tasks from synchronous to asynchronous channels would result from a decreased incidence in the factors contributing to memory errors such as distraction, interference and new involuntary additions to prospective memory.

There is much to be learned about the degree to and circumstances under which callers might choose to employ asynchronous channels. While call recipients would probably elect to deal with their calls at one time, the same is not likely of callers. Since each undone communication task remains an item in prospective memory, it is instead desirable to carry out communication tasks as the need for them occurs. Tasks that do not require immediate acknowledgement or completion lend themselves to asynchronous methods of communication. Under what circumstances might the employment of an asynchronous method form the sender's first preference, rather than the last resort, when attempts at synchronous communication have failed? Might callers choose their communication methods based upon the demands of the task, and could careful design of the technologies encourage a shift to task-based use of communications?

The effects of social influence upon technology use

There are a cluster of very interesting questions relating to the use of communications technologies and status. How might the choice and use of synchronous and asynchronous communications be affected (if at all) by an individual's status in the hospital hierarchy? Might the greater certainty of connection with junior staff encourage more 'selfish' behaviour by those higher in the hierarchy? That is, for routine communications, might more senior members of a team feel more free to interrupt junior members with synchronous communications, and conversely, would more junior members, more reluctant to interrupt, tend to use asynchronous voice messaging or email to communicate with senior staff?

As research with office[37-40] and health care workers[41] indicates, it is probable that staff would influence each other's adoption and patterns of use, and that local norms might evolve. Since communication technologies are essentially shared tools, the degree to which they may be fully exploited is contingent upon all parties to a communication being prepared to use, and feeling satisfied with their ability to use the capabilities provided. If, for example, one member of a team were reluctant to access text messages, the behaviour of other members of the team would either

have to evolve to accommodate that antipathy, or influence would have to be exerted to convince that team member to behave differently. Thus, it is probable that differences in use of available technologies might be seen from team to team, shaped by key individuals.

Effects upon the nature of conversations

Coiera and Tombs indicated that chance face-to-face meetings were an important medium of communication. One of the reasons that they were so eagerly seized upon was precisely because of the difficulties their study participants had in either locating colleagues or in setting up synchronous conversations. These meetings often provided the first opportunity one colleague had to confer with another on a particular matter and sometimes substituted for the failed attempts at earlier conversations.

We might expect that the use of voicemail and email would cause some changes to the *content* of opportunistic exchanges between colleagues. Instead of communications of the nature 'I need to speak to you about X', we could expect that opportunistic exchanges might instead be more of the nature 'did you read/receive/act upon my voice/text message to you about Y?' or 'thanks for your voice message about Z; I'll see to it this afternoon'. In other words, instead of representing the first opportunity one colleague has to communicate with another, opportunistic meetings might become opportunities to *confirm* earlier communications, and perhaps also to elaborate upon them.

Message Acknowledgement

Coiera and Tombs suggested that the need for acknowledgement of receipt of a message was one of the drivers behind the preference for synchronous communications. The cognitive reasons for this preference were discussed above: without confidence that the receiver has taken over the task, it remains as an unfinished task in the caller's WM. Acknowledgements could perhaps be required for different purposes. Has the message arrived safely in the recipient's 'in-tray'? Has the recipient listened to or seen the message yet? The message sender might require different types of acknowledgement to be able to feel that the communicated task has truly been delegated, and to feel able to 'remove' that task from WM.

Additional interesting questions are raised by research in the office on acknowledgements mediated by email[38]. In some circumstances, agreements mediated by email were not viewed by recipients as equivalent in strength or reliability as face-to-face agreements to a course of action. Co-workers wished to look each other 'in the eye' when negotiating and agreeing commitments. Might this also be found in the hospital environment?

Future research

We have hypothesised that in some cases, over-dependence upon synchronous channels of communication may come about because these conditions result in excessive burdens on

memory. At face value, synchronous communications may seem to offer the best way for completing some tasks and reducing unfinished tasked held in working memory, but in fact, difficulties with this channel ranging from unanswered calls to not knowing the location of a colleague often mean that many inefficiencies are introduced into the process.

These are hypotheses which require further examination in the field. Studying cognitive phenomena in a naturalistic setting is a method of enquiry that is increasing in popularity[43] and one that increasingly is seen to complement the older laboratory-based method of enquiry, to their mutual benefit. Laboratory studies, with their strict experimental controls, enable cause and effect relationships to be postulated and examined, and theory to be developed. However, laboratory experiments are often criticised as unrepresentative of real life. Field studies, on the other hand, lack this control, and therefore cannot demonstrate cause and effect relationships. This does not mean however, that laboratory based theory cannot be applied to the field, and used to shape and guide enquiry.

Given the complexity of this field of study, we propose a programme of research to address its many facets. At least three types of approach are required.

First, future studies should be designed specifically to examine memory errors in the hospital setting. Structured observation techniques[43] could be used to focus upon the occurrence of memory errors; and interviews with study participants could draw upon their own accounts of observed data. While self-accounts do not offer proofs of theory, they enrich and inform the observer's understandings; combined observation and interviews are the basis of ethogenic approaches[43]. The same approach is required to further understanding of communication behaviours. Further, semi-experimental studies may bridge the need to understand behaviours in a working environment whilst executing controlled experiments. For example, artificially structured memory tasks could be given to staff to carry out during their routine work.

Second, and informed by the ethnogenic approach, quasi-experimental studies[43,44] are needed which assess the consequences of introduction of new communications technologies. For example, asynchronous technologies may be introduced to a mobile and distributed team. Studies of relevant behaviours using before and after comparisons, as well as comparisons with a different team over the same period which has not used the new technologies should also be carried out. Because of the complexity of the phenomena under study, separate studies investigating communication behaviours and memory errors are likely.

Third, the introduction of new technologies also requires investigation of the social environment into which they are introduced. The ethnographic approach,[43,44] a method of observation focused upon learning the meaning for participants of particular behaviour will help in characterising the social aspects of the communication environment, and drive hypothesis construction and further experiments.

Conclusions

This report has taken a cognitive psychological approach to set the scene for future investigations of clinical communication behaviour. It has outlined some of the negative consequences that interruptive communication patterns could have upon the ability of hospital staff to manage successfully their current and impending task loads. It has detailed several characteristics of human memory which might contribute to greater burdens. It has indicated some of the characteristics of tasks that contribute to the probability that they will be forgotten in interrupt-driven circumstances. It has suggested that the degree of an individual's expertise is one characteristic that could discriminate between the differing vulnerability of individuals to interruptions. Finally, it has combined this cognitive approach with a social information approach to consider the effects of new communications technologies in the interrupt-driven environment of the hospital.

This approach reveals that there is great scope for studying existing communication patterns and work practices in hospitals in order to understand their effects upon memory and task performance. This is a necessary precursor to developing an understanding of the consequences of introducing of new communications technologies.

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