Seeing but not Perceiving: Inattentional Blindness as a cause of Missed Cues in the General Practice (GP) Consultation

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ABBREVIATIONS

ASD autistic spectrum disorder | CCTV – controlled circuit television | CPR – cardiopulmonary resuscitation | CT – computerised tomography | GP – General Practice
IB – Inattentional Blindness | VR-CoDES – Verona coding definitions of emotional sequences

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What this paper adds:

Inattentional Blindness (IB) is a well-known phenomenon in the field of psychology, but there is very little research within the field of healthcare. This paper suggests that IB could be a significant factor into why doctors in General Practice (GP) frequently fail to respond to cues made by their patients.

Abstract

Background: It is well known that healthcare professionals, including GPs, frequently fail to respond to cues made by their patients. A possible explanation for this behaviour is that the phenomenon of IB could lead to a failure to observe the cue, rather than a deliberate choice to ignore it. This study sought to explore that possibility, and to consider whether GP trainees are more susceptible to IB than GP trainers.

Methods: The research was a case study involving two groups of participants - GP trainees and GP trainers from a localised GP Training Scheme. Actors were used to record a video of a pre-defined GP consultation involving a patient affected by headaches, who gave two significant cues which were not responded to in the video. Participants observed the video while being asked to focus on the diagnosis and management of the patient's headaches, following which they completed a questionnaire, including questions about the cues.

Results: Cues were missed by 24-53% of participants, suggesting a high rate of IB within the GP consultation. Unexpected findings included the recording by some participants of false observations from the video. There was no significant difference between trainers and trainees in the rates of IB.

Conclusion: IB appears to be a real and significant phenomenon within the GP consultation, and is likely to have important implications for patient care. More research is needed to confirm these findings, establish IB rates as a

cause of missed cues among healthcare professionals and evaluate possible interventions to reduce susceptibility to IB.

Introduction: The definition of a cue within healthcare was reached at a consensus meeting held in Verona in 2008 (Del Piccolo, Finset and Zimmermann, 2008). The agreed definition is: "*verbal or nonverbal hints, which suggest an underlying unpleasant emotion and that lack clarity*" (p.3). The ability to respond to cues is deemed to be such an important skill for GP trainees to learn that it is a requirement for the completion of training (Royal College of General Practitioners, 2015). Moreover, research among lay people has shown how valued it is by patients (Mazzi *et al.*, 2013). However, there is clear evidence that doctors frequently fail to pick up on such cues (Levinson, Gorawara-Bhat and Lamb, 2000; Butow *et al.*, 2002; Zimmermann, Del Piccolo and Finset, 2007; Riley *et al.*, 2013).

It is often assumed that doctors notice cues and yet *choose* not to pick up on them, due for example, to pressures of time, or a lack of confidence in their ability to 'fix' the emotional problems that might be uncovered (Levinson, Gorawara-Bhat and Lamb, 2000). Another suggestion, by Riley *et al.* (2013), is that a lack of empathy might be to blame and could explain why male doctors responded to fewer cues than female doctors in their study. There is evidence of gender discrepancy in the ability to express empathy to support such a hypothesis (Cohn, 1991; Thompson and Voyer, 2014), and studies among doctors consistently show that female physicians are more likely to engage in emotionally focused talk with patients than their male counterparts (Bylund and Makoul, 2002; Roter, Hall and Aoki, 2002). Certainly, perceived empathy in the consultation is valued by patients and is even linked to improved clinical outcomes (Cape, 2000; Derksen, Bensing and Lagro-janssen, 2013), and it seems likely that responsiveness to cues is an important component in showing empathy.

While the factors described above may play a role in why doctors often fail to respond to cues, another plausible hypothesis is that doctors sometimes ignore cues because they simply fail to notice them in the first place. This could be because the doctor has heard the cue, but failed to recognise it as such; indeed, Cocksedge and May (2005) describe how the first ingredient for listening is to be able to recognise that listening is required. An alternative explanation however, could be that the doctor would have recognised a cue had they noticed it, but they simply failed to register the communication at all and so failed to consider whether or not it could be a cue. Neighbour (2005) describes a framework that could account for this. He envisages the doctor as having two heads: the *Organiser* and *Responder*, which compete for the doctor's attention. The *Organiser Head*, with a focus on areas such as formulating a diagnosis and a management plan, can sometimes drown out the *Responder Head*, which is more attuned to picking up cues and expressing empathy. While Neighbour's model is attractive, it is theoretical rather than evidence-based. In order to understand this further, evidence is needed for whether or not doctors could be so distracted during a consultation as to be blinded to patient cues.

Psychologists Chabris and Simons (2011), define the phenomenon of Inattentional Blindness (IB) as an "*error of perception… from a lack of attention to an unexpected object."* (p.6). In practice, this means being so focused on a task that one fails to see something else which ought to be obvious. The authors illustrated this phenomenon using the now classic gorilla experiment (Simons and Chabris, 1999), inspired by Neisser's earlier studies on visual perception (Neisser, 1979). Chabris and Simons made a video of two teams of people passing basketballs (Simons, 2010a), with one team dressed in white and the other in black. During the recording, a member of the team dressed in black left the scene and was replaced by someone wearing a gorilla costume, who walked across the stage, stopped, and beat their chest before leaving. Students who watched the video were asked to count the number of passes between the players of the team dressed in white, after which they were asked if they had noticed anything unusual. Astonishingly, approximately half had no recollection of seeing a gorilla. The experiment has been repeated on multiple occasions, with diverse groups of subjects and it achieves consistent results. Interestingly, when subjects watch the video without being given the task, almost all see the gorilla, hence it is the task that blinds them.

This study sought to explore the possibility that tasks such as making a diagnosis and formulating a management plan could make GPs susceptible to IB, resulting in missed cues. Since the cognitive load of a task is well known to increase the rate of IB (Simons and Chabris, 1999; Cartwright-Finch and Lavie, 2007), trainees, who tend to find such a task more demanding than experienced GPs, could be particularly susceptible to this phenomenon. Understanding susceptibility to IB will have important implications for training, since if trainers are no less susceptible to IB than trainees, then training methods for GPs, both during training and once qualified, may need to be adjusted to address this. This study therefore, also compares rates of IB between trainees and trainers.

Background: In their systematic review of the literature on patient cues from 1975-2006, Zimmerman, Del Piccolo and Finset (2007) concluded that "*definition of cues and concerns… differed widely*" (p.1); a problem which led to a collaborative meeting in Verona in 2008, resulting in the

Verona coding definitions of emotional sequences (VR-CoDES) (Del Piccolo, Finset and Zimmermann, 2008). The Verona consensus of what constituted a cue was: "*verbal or nonverbal hints, which suggest an underlying unpleasant emotion and that lack clarity and would need a clarification from the health provider*," while a concern was defined as: "*a clear and unambiguous expression of an unpleasant current or recent emotion where the emotion is explicitly verbalized*." (p.3). It might be expected that doctors would be more likely to respond to an explicitly stated concern and to miss the more hidden cues, although Zhou *et al.* (2013) found that medical students responded to certain cues more frequently than concerns.

It is clear from the literature that cues are common, although the frequency of such cues varies widely. For instance, Levinson, Gorawara-Bhat and Lamb (2000) found 51 cues in their analysis of 54 GP consultations – fewer than one per consultation, while Riley *et al.* (2013) recorded 3.9 cues or concerns given by the patient per consultation, and Zhou *et al.* (2013), as many as nine per consultation. There are challenges in comparing these studies, since the latter two included both cues and concerns, while Levinson, Gorawara-Bhat and Lamb published their work before the VR-CoDES codes were published, and hence had no standardised definition of cues to refer to. Consultations without cues do occur, although their rarity is confirmed by Del Piccolo *et al.* (2007), who recorded 11 out of 246 such consultations in their study.

Factors affecting the frequency of cues are complex, being dependent on both patient context and physician factors. In contrast to gender differences among doctors in expressing empathy, Bylund and Makoul (2002) found no gender difference in the number of cues expressed by male and female patients, although a review of the literature by Wester *et al.* (2002) concluded that there are gender differences in the expression of emotion. Webster *et al.* (2002) felt this may relate to conformity to expected gender stereotypes as much as genuine biological difference, although the cause of such differences is probably less relevant to the GP than the fact that they exist. Cultural factors have also been shown to affect cue rates (Schouten and Schinkel, 2015), but perhaps more importantly, the nature of the problem has an impact, with emotional distress increasing cue frequency (Del Piccolo *et al.*, 2007). The style and skill of the doctor also has an impact on cue frequency. Initial research focused on the skill of the doctor being important for 'eliciting' cues (Morriss, 1992; Goldberg *et al.*, 1993), with a high cue rate being assumed to be a marker for a more patient-centred consultation. However, Del Piccolo *et al.* (2007) found the seemingly contradictory finding that while competent handling of emotional distress by the doctor preceded patient cues, a more open, patient-centred consultation was associated with fewer cues overall; perhaps by reducing the need for cues by diminishing emotional distress.

Just as what constitutes a cue requires a consensus definition, so too does the response to a cue, since if the rate of response to cues is to be compared, it is important to know what a positive response looks like. The standardised definition of physician response to cues was only developed as recently as 2011 (Del Piccolo *et al.*, 2011), and so while this does not invalidate research before that date, it does mean that caution needs to be used when comparing research before and after this watershed publication.

Response rates to cues are variable. Levinson, Gorawara-Bhat and Lamb (2000) found only 21% were met with a positive response from a GP, although surgeons performed better with a 38% positive response, while Riley *et al.* (2013) found a 53% positive response by GPs, rising to 72% by pharmacists and 81% by nurses. Finset, Heyn and Ruland (2013) had similar results, finding that nurses were over five times more likely to provide listening space in response to a cue than oncologists (OR 5.01; $p<0.0001$). However, this study also found that among the doctors, female gender was strongly associated with a positive response to a cue (OR 2.01; $p<0.05$), and while there was no difference with gender among the nurses, there were only two male nurses in the study group out of 19, compared with four out of five among the oncologists. Since gender can influence expression of empathy, as previously discussed, such a significant gender difference between the groups could be an important confounder to the effect of occupation. The higher positive response rate among nurses in Riley *et al.'s* study (2013) is unlikely to be related to consultation length, since nurse consultations were on average only one minute longer than GP consultations. Nor did it relate to the frequency of cues, which were the same in both groups, although there were some differences in the nature of cues with those related to depression or mood being more common in the GP consultations. This could be significant, since the nature of the cue appears to be important; Butow *et al.* (2002) found a higher response rate among oncologists to informational cues (72% appropriate response) when compared to emotional cues (38%), while Del Piccolo *et al.* (2015) found that neurologists were more likely to close down cues in anxious patients. Such cues are likely to be more demanding on the doctor, although it is reasonable to argue that they may be more important to the patient.

A systematic review by Zimmermann, Del Piccolo and Finset (2007) analysed 58 studies across a range of medical specialties and concluded that physicians missed most cues and had adopted behaviours that discouraged disclosure. This begs the question: what is the *correct* rate of response? A 100% response would imply no room for discretion on behalf of the healthcare professional and yet disregarding patient cues can lead to less humane treatment (Barry *et al.*, 2001) and adverse outcomes (Salmon, 2006).

While there has been a great deal written about why doctors might not respond to a cue, there is little consideration given to the possibility that they might not notice a cue in the first place. For instance, Cocksedge and May (2005) interviewed 23 experienced GPs and found there was acceptance that the GP could only respond to a cue if they spotted it, but placed the emphasis on the ability to recognise that something is a cue, rather than raising the possibility that an obvious cue could simply go unseen.

There is very little research into the possible impact of IB in a healthcare setting (Greig, Higham and Nobre, 2014; Jones and Johnstone, 2017). Jones and Johnstone (2017) reported a series of four case studies where IB was postulated as the reason why clinical deterioration in the acute medical setting was not acted upon by medical staff. IB is a plausible explanation for this observation, but similar clinical errors could also be explained through cognitive bias (Saposnik *et al.*, 2016). In particular, anchoring bias (a tendency to jump to conclusions too quickly and fail to challenge such conclusions), and confirmation bias (a tendency to give more weight to new evidence that confirms earlier assumptions than to contradictory evidence), can both explain the failure to adapt to new clinical information (Croskerry, 2002). A study by Greig, Higham and Nobre (2014), used a 50-second video of cardiopulmonary resuscitation (CPR) which included a clearly visible and audible accidental disconnection of the oxygen supply to the patient. Participants watched the video and were asked to be prepared to comment on the appropriateness of the CPR and defibrillation technique. At the end, the participants were asked to say whether or not a number of events had occurred during the video, including oxygen malfunction. Even when prompted, only 24% of participants noticed the oxygen problem; a clear demonstration that both Inattentional Blindness and Inattentional Deafness can occur in a medical setting.

Since radiology is a specialty which is highly dependent on visual perception, it is an ideal setting to investigate the possible role of IB in medicine. Lum *et al.* (2005) describe a case of a misplaced femoral guidewire that was left *in situ* and unseen on several x-rays and a Computerised Tomography (CT) scan read by radiologists, intensivists and emergency physicians. Drew, Vo and Wolfe (2013) put this case study to the test by purposefully placing a gorilla-shaped lesion onto a CT chest scan. The gorilla was present on five of the CT slices, but when this scan was viewed by 24 radiologists looking for lung nodules, only four reported seeing the gorilla, despite the fact that it measured 29 x 50 mm; nearly 50 times larger than a typical lung nodule.

Visual observation is also crucial in surgery and there is some evidence that IB could play a role in missed observations and therefore risk surgical errors. Hughes-Hallett *et al.* (2015) asked 73 surgeons to observe a video of a surgical procedure where two unexpected foreign bodies were present in the field of view – a swab was present in the periphery of vision and a suture in the centre of the field of view. Even for the central object, IB affected 10% of subjects, while 74% missed the peripheral object. Interestingly, the subjects were divided into two groups which were subjected to different cognitive loads. One group simply observed the video while the other was asked to keep a count of instrument movements. The level of IB was significantly higher for the high cognitive load group for the swab in the periphery (92% v 53%; $p<0.001$), but there was no significant difference for the misplaced central suture, where inattention levels were very low in both groups. This suggests that where an object is sufficiently ‘obvious’ then IB becomes a rare event, although this may also be explained by a misplaced suture being a relatively expected surgical event, compared to for example, the gorilla-shaped lesion in Drew, Vo and Wolfe’s CT study (2013), which has no relevance to real medical practice.

One of the most powerful influences on the susceptibility to IB is cognitive load. This was famously, and tragically, demonstrated in the fatal crash of Eastern Airlines Flight 401 in 1972. The report into the deaths of 101 people on board concluded that the flight crew became so distracted by the possible malfunction of a landing gear that they failed to notice both visual and audible alarms indicating a rapid and unexpected descent (National Transportation Safety Board, 1973). The stressful possibility that the plane’s wheels might not be in position for landing, created what is known as ‘high cognitive load’ (Lavie, Beck and Konstantinou, 2014), resulting in both Inattentional Blindness and Inattentional Deafness. The assumption that cognitive load was critical in this real-life event is backed up by research studies, which consistently show increased rates of IB when cognitive load is increased (Dehais *et al.*, 2014; Lin and Yeh, 2014; Murphy and Greene, 2016).

This study compared rates of IB between trainees and trainers, but what factors might predict a difference between the groups? It is possible that trainees are subject to a higher cognitive load when consulting than a more experienced GP trainer, since as they have less experience, they may have to ‘think harder’. Indeed, the work of Dreyfus and Dreyfus (1980), extended to a healthcare setting by Benner (1982), describes the naturalisation of cognitive processes as a learner transitions from novice to expert through the acquisition of concrete experience. However, it is difficult to measure the degree of cognitive load one group will experience compared with another group, given the same task. There is some evidence that experience can reduce susceptibility to IB. For example, Memmert (2006) found that basketball players were more likely to see the gorilla in the original experiment from Simon and Chabris (1999) than those without this experience. However, there is also evidence that while the difficulty inherent in the task associated with cognitive load is a key factor in predicting the degree of IB, individual ability to perform this task is not predictive of IB susceptibility (Simons and Jensen, 2009). Cognitive load could also be generated from work pressures external to the clinical problem being dealt with at that time, such as overall workload and leadership responsibilities; factors which may impact trainers more than trainees, and which have certainly increased in recent years (Hobbs *et al.*, 2016; Thompson and Walter, 2016).

It might be assumed that intellectual ability could protect an individual from IB, but the evidence suggests otherwise. Most researchers have found that cognitive factors, such as working memory capacity, have little if any, impact on IB rates (Kreitz *et al.*, 2016; Beanland and Chan, 2016), although Richards, Hannon and Derakshan (2010) did find an association between low working memory capacity and IB rates. The way an individual's brain is 'wired' does seem to be an influence, with individuals on the autistic spectrum (Olney, 2000; Swettenham *et al.*, 2014) and those affected by Attention Deficit Hyperactivity Disorder (Grossman, Hoffman and Berger, 2015) being less susceptible to IB, while personality traits such as openness to new experience, can also be a protective factor (Kreitz *et al.*, 2015). Age has been shown to be associated with increased rates of IB (Horwood and Beanland, 2016), which could affect trainers more than trainees, but this study compared adults aged 60-80years with those aged 18-25years, which represents a significantly wider age gap than would be present among groups of working doctors. With so many varied factors potentially influencing IB rates, any hypothesis that trainees as a whole could be more susceptible to IB than trainers, could prove to be too simplistic.

Most of the research into IB, including Simon and Chabris' original gorilla experiment (2011), has been conducted under laboratory conditions with tightly controlled variables, which enabled the researchers to test a single sensory modality at a time, be it visual (Kreitz *et al*., 2014), auditory (Dalton and Fraenkel, 2012; Raveh and Lavie, 2015) or even touch (Murphy and Dalton, 2016). Testing for IB in a real-life GP setting is more challenging due to the complexities of human interaction. Patient cues are clearly auditory, but since much of communication is non-verbal, they must be visual as well; failing to observe a cue would therefore involve both Inattentional Blindness and Inattentional Deafness. Real-life situations involving both auditory and sensory modalities have been studied, most famously in the 'Door' study (Simons and Levin, 1998; Simons and Levin, 2010), where a researcher initiated a conversation with a stranger in a public place, only for the conversation to be interrupted by two people carrying a door. During the interruption, the original researcher was replaced by one of the door carriers, yet 50% of people failed to notice the switch. This study certainly involved both auditory and visual components, but it could be argued that it was not real life since people do not suddenly change places in normal life. Chabris *et al*. (2011) simulated a real-life situation in a later study, by replicating a situation from 1995, in which a Boston police officer, chasing a suspect, ran past a brutal assault and was prosecuted for perjury when he claimed not to have seen it. In their study, only 35% of participants noticed passing a staged fight while pursuing one of the researchers. As well as producing a fascinating insight into a possible miscarriage of justice, this demonstrates that real-life research into IB is certainly possible.

The authors have been unable to find any published research into the role of IB in a primary care setting. As a GP trainer, the lead author of this research was particularly struck by the phenomenon of missed cues when doing a joint consultation with a trainee. The patient used the highly unusual phrase '*after my mother was killed*' which the trainee appeared to ignore. Afterwards, the trainee could only recall that the patient's mother had died and had no recollection of the word 'killed'. Neighbour's (2005) idea that the doctor has two heads, seemed to give a plausible explanation for the experience of this trainee. Was the trainee's *Organiser Head* so distracted by the medical problem and how to treat it, that their *Responder Head* was not able to notice the cue at all?

Methods: A purposive sample of 20 GP trainees and 17 GP trainers from a local GP training scheme were recruited. A pilot study was conducted with four GP trainees in order to test the technical aspects of data collection, including the reliability of the questionnaire.

A video of a GP consultation was made, using a patient actor (a trained simulator) and a volunteer GP trainer. The video consultation was written as a case scenario of a woman presenting with headaches. Before watching the video, participants were asked to concentrate on the nature and diagnosis of the patient's problem and the performance of the doctor, thus giving a cognitive load which resembled the thought processes of a doctor whilst consulting. Participants were asked not to take notes during the video and to complete the questionnaire immediately after the video ended.

The video simulation involved the patient giving two predetermined 'cues', which the doctor (actor) in the video was asked *not* to respond to: one relating to the patient's mother being killed, and the other to the patient's symptoms being problematic at work. These cues were both compatible with the VR-CoDES definition of a cue

(Del Piccolo, Finset and Zimmermann, 2008). The scenario was not scripted throughout, since if it appeared unnatural, it might be distracting to the participants, but the actors were asked to use prescribed phrases when it came to the cues. The clinical scenario of headaches was chosen since headaches comprise a clinical problem which requires a significant degree of clinical enquiry in order to make a diagnosis (thus giving the participants the primary task that they were asked to focus on), whilst also having the potential for significant psycho-social contextual factors to become apparent (thus making the presence of cues significant).

Questionnaire: Participants were asked to complete a questionnaire containing key questions relating to the two cues, plus a 'dummy question' to test observation of the primary task (see Figure 1).

Two questions relating to cues:
Cue 1: Did the patient mention her mother? (Answer yes/ no/ don't know)
If so, what did she say about her mother? (Please be as precise as you can, using the patient's exact words if possible)
Cue 2: Did the patient mention her job? (Answer yes/ no/ don't know)
If so, what did she say about her job? (Please be as precise as you can, using the patient's exact words if possible)
The 'dummy' question: Did the patient have any visual symptoms with her headache? (answer yes/ no/ don't know)

Figure 1: Participant Questionnaire

For the 'killed' cue to be regarded as having been observed, the respondent had to state the word 'killed' in their answer, rather than simply 'died'. It is possible that some participants observed the cue fully but did not appreciate the importance of using the word 'killed' in their answer. However, by asking them to be 'as precise as you can' and to 'use the patient's exact words where possible,' the research design mitigated against this possibility. It was felt that the patient's use of the word 'killed' rather than 'died' significantly increased the emotional intensity of this cue, in-keeping with evidence that more sensational content in a narrative makes stories more memorable (Mccabe and Peterson, 1990); moreover, it implied a potentially significant underlying psychological concern relating to how the patient had come to terms with her mother's death.

For the second cue to be positively identified, the respondent needed to state that the patient's problem was affecting her work; any wording that described this was deemed acceptable, for instance 'affecting work', 'causing problems at work', or 'bothering her at work.'
The purpose of including the dummy question was because one possible explanation for failing to observe the cues would be if the participants were simply not engaged in the process. In contrast to an actual consultation where the doctor has to engage with the patient in order to come up with a management plan, when watching a video recording it would be entirely possible to daydream throughout and so miss the cues by simply not watching. Inattentional Blindness does not mean simply not paying attention, it is blindness due to attention being strongly focused elsewhere so that the unexpected event goes unnoticed. A dummy question was included in order to consider this possibility, which was for the participants to say whether or not the patient had any visual symptoms. Participants were asked to focus on the diagnosis of the patient's headaches and since the presence or absence of visual symptoms is an important part of making the correct diagnosis, a participant focused on the primary task ought to have noticed this. The answer was deemed to be correct if the respondents answered that the patient did not have visual symptoms, and incorrect if they answered either 'yes' or 'don't know' or did not answer the question.

Primary Outcome: The primary outcome measures were to ascertain whether or not cues were observed, and to compare the rates of missed cues between the two groups.

Results: Of the 37 participants, all gave an answer to both cue questions and 36 gave an answer to the dummy question. In one case, the dummy question was left blank, and this was regarded as a 'don't know'. Where respondents answered 'yes' to the 'killed' cue, all then completed the second question, detailing what the patient had said about her mother. However, for the 'work' cue, two respondents answered 'yes' to the fact that she had mentioned her job, but then left the follow-up question blank. These were regarded as not having observed the cue, since the answer did not satisfy the criteria set out in the methods section. With regards to the dummy question, all the incorrect answers were 'don't know', apart from one failure to answer the question. Incorrect answers were higher than expected, and the implications of this will be considered in the discussion.

Main Findings: The 'killed' cue was missed by 40% of GP trainees and 24% of trainers (Table 1), while the 'work' cue was missed by 45% of trainees and 53% of trainers (Table 2). Although the trainers had a lower percentage of missed 'killed' cues, there was no statistical difference between the two groups (*p*=.138) suggesting that there is no association between training status and susceptibility to IB. There was also no statistical difference between trainers and trainees for the 'work' cue (*p*=.63).

'Killed' cue	Cue observed	Cue missed	*p*
Trainees (n=20)	12 (60%)	8 (40%)	
Trainers (n=17)	13 (76%)	4 (24%)	
Total (n=37)	25 (68%)	12 (32%)	*p*=.13

Table 1: Response to Killed Cue

'Work' cue	Cue observed	Cue missed	*p*
Trainees (n=20)	11 (55%)	9 (45%)	
Trainers (n=17)	8 (47%)	9 (53%)	
Total (n=37)	19 (51%)	18 (49%)	*p*=.63

Table 2: Response to Work Cue

Statistical analysis was also performed for the dummy question, to see if there was any difference between the two groups in observing this feature in the consultation. There was no significant difference between trainers and trainees (*p*=.72).

In order to understand the implication of these results, it is worth comparing them with the research on doctors' response to cues, as well as other research in the field of IB. As previously discussed in the literature review, the response rates of doctors to cues in observed consultations, show positive response rates as low as 21% (Levinson, Gorawara-Bhat and Lamb, 2000), and as high as 53% (Riley *et al.*, 2013), or, put the other way around, rates for failure to respond to cues of between 47-79%; these figures are not much greater than the missed cue rates of 32-53% in this study. It would be unreasonable to suggest that IB could account for all missed cues as there are surely some instances where a doctor observes a cue but chooses not to respond to it and yet the results from this study suggest that IB could account for a significant doctors are directly observed.

The rates of IB of 32-53% found in this study are comparable with research into IB in other contexts, both the 'gorilla' study (Simons and Chabris, 1999), and the 'Door' study (Simons and Levin, 1998), recorded IB rates of 50%, although as we have seen, rates vary depending on the nature of the unexpected object and the degree of cognitive load; for instance, by changing these two variables, Hughes-Hallett *et al.* (2015) recorded IB rates as low as 8% and as high as 91% in their study.

The results therefore, are both comparable with expected rates of missed cues within the consultation and the expected rates of IB from the literature.

Unexpected Findings: Somewhat unexpectedly, four of the participants gave answers that were either completely or partially false, all related to the 'killed' cue. Three made bold, confident statements that were entirely untrue (untruths in italics):

"Mother died 2 years ago. *Patient asked if headaches could be related to this*"

"*Her mother suffered with HA"* (HA presumably means 'headaches')

(Her mother) "*died in a car accident"*

While a fourth respondent added false information, although they were clearly not sure about this:

"The headaches came after her mother's death *?RTA"*

(RTA = Road Traffic Accident. It is commonplace among doctors to put a question mark before a statement that is possible, but uncertain – for example, 'Abdominal pain ?appendicitis').

It is interesting to consider what a real-life patient would think, had they asked to see their notes and found that the doctor had written such false statements. These unexpected findings raise intriguing questions which will be considered further in the next section.

Discussion: This small study serves as preliminary evidence that high rates of unobserved cues by GPs, could account for a significant percentage of missed cues in real-life situations, and provides good evidence that IB has an important impact on GP consultations.

Inattentional Blindness, or Inattentional Daydreaming? As discussed previously, a dummy question relating to the presence or absence of visual symptoms in the history was included to determine whether or not participants were engaged in the primary task of trying to make a diagnosis and consider management. It was somewhat surprising that 30% of trainees and 24% of trainers were not able to answer this question. This result requires some consideration. If the participants who were unable to answer the dummy question were entirely disengaged, one would expect a high degree of missed cues among this subset. In fact, while five out of 37 study participants

missed both cues, not one of them was in the subset of those who missed the dummy cue; demonstrating that those who missed both cues were focused on the primary task, while those who missed the lack of visual symptoms were all sufficiently engaged in the video to pick up at least one of the cues. If lack of engagement is not the cause for missing this information, what could be the explanation?
It has long been established that patients fail to recall a large proportion of the advice that their doctors give them (Ley, 1979; Kessels, 2003) and so it should not be surprising if doctors also get overloaded with the information provided by their patients. Perhaps, despite the video being considerably shorter than an average GP consultation at just over six minutes, the participants were simply provided with too much information to recall it all. Unfortunately, there seems to be a lack of research into what doctors recall from a consultation, and so there is little direct evidence either for or against this possibility. It is worth noting that the dummy question was a negative in that the patient did not have visual symptoms; it is entirely possible that the lack of symptoms would be less memorable than if she had described visual symptoms. As mentioned above, there is evidence that more sensational content makes a narrative more memorable (Mccabe and Peterson, 1990), and while the presence of visual symptoms could not be described as sensational, it is certainly more interesting than an answer in the negative. Hence, the dummy question might have been more effective if the case had included visual symptoms too.

Inattentional Blindness or Inattentional Amnesia? There is an enduring problem in the field of IB research that it can be extremely difficult to distinguish between a failure of attention and a failure of memory (Block, 2011). While some studies, like the CT lung nodule study previously mentioned (Drew, Vo and Wolfe, 2013), require participants to record their observations immediately, many others, including this present study, rely on records made shortly after the observation event – including, for instance, Simons and Chabris' original gorilla experiment (1999) and Greig, Higham and Nobre's use of a staged resuscitation video (2014). Since there was a time lag between the observation event and the recording of the observation in this study, an alternative explanation for the findings is that the participants could have observed the cues, but then rapid degradation of memory could have led to the incorrect answers. Some studies have been successfully designed to differentiate the two factors at work in favour of IB (Rees, Russell and Driver, 1999; Ward and Scholl, 2015), but these are mainly laboratory-based studies and far removed from real life. This study by contrast, reflects a real-life situation, in which medical notes are usually written immediately after the patient has left the consultation room. Therefore, it could be argued that whether the results are explained by a failure of observation or of memory is immaterial, since the result to the patient of inaccurate recording in the notes, is the same.
Chabris and Simons (2011) describe the *illusion of memory*, an explanation of many of the failings of memory. We are all familiar with the concept that memory fades over time, but even immediate recall can be affected, such as the description by these authors of how two witnesses of a knife attack differed significantly in their immediate description of the event to the emergency services, being unable to agree on the clothing and even the race of the attacker. Memory can not only fade, but also fill in the gaps, as demonstrated in a clever experiment by Brewer and Treyens (1981). These researchers invited participants to wait in a graduate student's office, and after 30 seconds were unexpectedly taken to another room and asked to recall as many objects as they could from the previous room. Almost all subjects recalled common objects, such as a chair, a table and shelves, but 30% also recalled seeing books on the shelves when unusually, there were none present. There is evidence of the same phenomenon happening in this study; when two participants recalled that the patient's mother had died in a road traffic accident, they filled the gap between hearing the words 'was killed' and a plausible but imagined mode of being killed. Similarly, just as we expect to see books on shelves, as doctors we expect headaches to sometimes run in families, and we expect patients to tie headaches to traumatic events. Hence the confabulated statements that the mother had also suffered from headaches and the patient asking if the headaches could have been caused by her mother being killed.
The present study cannot differentiate between the possibility that the findings are explained entirely by IB, by a degradation of memory, or both phenomena, because of the delay between the cue begin given and the end of the consultation. Further light could be shed on the current investigation by repeating the study but stopping the video soon after the cue is given and then asking respondents to recall the cue. This would however, limit the study to a single cue only, and might introduce new difficulties by unexpectedly interrupting the video in this way, due to the well-described Hawthorne effect, where the act of observing research subjects significantly alters their behaviour (Sedgwick, 2012). Indeed, the Hawthorne effect is difficult, or even impossible to eliminate altogether and in the present study, the knowledge that the participants were being tested on in the video may have led to changes in their behaviour whilst they watched.

Group Comparisons: There was no significant difference in IB rates between trainees and trainers, which is one of the key findings of this research and has important implications. The study sample size was small and so it could have lacked sufficient power to detect a true difference. If further studies confirm that IB is a significant factor in the failure of GPs to respond to cues in the consultation and GP trainers – *who are specifically trained to teach trainees how to pick up cues* – are as susceptible to IB as their trainees, then what does this say about GP training? Clearly, the implication is that current GP training, expertise gained by working for years as a GP, and educational training to become a trainer, are insufficiently able to address the problem of IB in this context. The key question in response to this is therefore, could training be undertaken to reduce susceptibility to IB?

While general communication skills training can have positive results (Jenkins and Fallowfield, 2017), since IB has not previously been recognised in the GP consultation, there is no research specific to General Practice in this area. However, there have been some attempts to address this question in the field of IB research. It is known that expertise itself can have some impact, as demonstrated for instance in Memmert's (2006) study, that expert basketball players were more likely to detect the gorilla in the classic gorilla experiment. This effect is not consistent across studies however, and in a more real-world study of Controlled Circuit Television (CCTV) operators, Näsholm, Rohlfing and Sauer (2014), found that prior experience did not inocculate against IB. What about raising awareness of IB as a way of reducing susceptibility? There is evidence that knowledge of IB may protect against a known example of IB, but it seems to be ineffective at preventing IB in other unexpected events. For example, in a clever adaptation of the gorilla experiment, Simons (2010b) added two extra unexpected events, including a change in the colour of the curtain behind the actors in the video and one of the players leaving the scene. He then studied two groups of participants; one which was familiar with the gorilla experiment and another which was not. The familiar group consistently observed the gorilla, but were slightly *less* likely to spot the curtain change than those who were unfamiliar; presumably they had a cognitive load for watching out for the gorilla which actually increased their Inattentional Blindness to another change. This result may not generalise to other situations, however, since these participants were looking for the gorilla, rather than being simply more aware of the phenomenon of IB, it may still be possible that a general awareness of IB could be protective.

There have been some studies of interventions to reduce IB rates, including the effects of a brief mindfulness intervention before undertaking the task (Schofield, Creswell and Denson, 2015). In this study, participants who undertook a brief 7-minute mindfulness activity prior to the task, had lower rates of IB during the task. Presumably, the mindfulness activity reduced the cognitive load in the intervention group, making them less susceptible to IB, although interestingly, subjects were also divided by those given a stressful writing task prior to the intervention (described as making the subjects 'depleted'), and there was no association between depletion and IB rates, meaning that stressing someone prior to the task had no impact on IB rates, while relaxing them with mindfulness did have an impact. The reasons for this need to be explored further, but since the stress occurred before the mindfulness task or control task, it may be that the effects of either stress or mindfulness are short-lived, which has significant practical implications, as 7 minutes of mindfulness before a whole surgery may be manageable, but since a GP may easily see 30 patients in a day, it would not be feasible prior to seeing every patient.

Richards, Hannon and Derakshan (2010) were able to demonstrate that training on a challenging, focused task (stating the colour of a word when the colour and word did not match, e.g. stating 'blue' for this word: **Red**), did reduce the incidence of IB to unexpected objects when completing the task; the theory being that such training frees up attentional resources, allowing more space for attention to unexpected events. This would support the notion that by simply teaching trainees to get better at the task of consulting, the incidence of IB would fall. Since this study did not find an association between training status and IB rates however, it does not support the idea that this works in a GP setting, but much more research is required to be able to answer this definitively. Moreover, even if training was found to reduce the rate of IB, questions would arise as to how to maintain this once core GP training had been completed. Allied professions such as psychotherapy have systems in place to ensure on-going supervision throughout a practitioner's career and there is some evidence that this is effective in maintaining performance (Lambert and Ogles, 1997), but there is no equivalent support in place in General Practice.

Implications: The possibility that doctors could be susceptible to IB in the consultation has significant implications. Patients no doubt, would be worried to hear that doctors might be blind to what they are seeing and hearing, and even angry to know that a doctor could write factual errors in their notes immediately after consulting with them, and yet, given the uncommon, but clinically very significant errors that were written on the responses, we have to conclude that doctors will, in good faith, sometimes record untruths in their notes. A greater understanding of this phenomenon could improve consulting and also protect doctors from litigation if it is acknowledged that such mistakes can and will happen when humans interact. Given that IB probably does occur in the consultation and that it is likely to detract from good consulting, a key unanswered question is whether or not it is possible to train doctors in such a way as to reduce susceptibility to IB.

Conclusions: As far as the authors are aware, this is the first study to look at the possible effect of IB in the GP consultation. The findings suggest that IB could play a significant role in why GPs frequently fail to respond to the cues made by their patients, and thereby have a significant detrimental effect on GP-patient interaction. Given the presence of IB in a wide variety of real-world situations, including aviation (National Transportation Safety Board, 1973; Dehais *et al.*, 2014) and driving (Most and Astur, 2007; Murphy and Greene, 2015), as well as emerging evidence of IB in other medical specialties (Drew, Vo and Wolfe, 2013; Greig, Higham and Nobre, 2014), it should not be surprising to discover its effect in General Practice. Moreover, there are good evolutionary reasons why humans need to have a degree of IB, since the human brain is constantly bombarded with sensory input, the ability to ignore irrelevant incoming data is crucial to being able to function as human beings, and in particular, to be able to perform a focused task. This may even explain the findings, discussed in the literature review, relating to why people with Autistic Spectrum Disorder (ASD) have lower rates of IB (Swettenham *et al.*, 2014), since many people with ASD have increased levels of visual selective attention, which can bring with it the problem of sensory overload (Olney, 2000). It is unrealistic therefore, to think that IB can be eliminated completely, but there is much more to discover about its role within the GP consultation, and ways to tackle it. The implications for GP training are considerable, but before recommendations can be made to tackle this problem there needs to be a much greater understanding of what interventions if any, could be effective.

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