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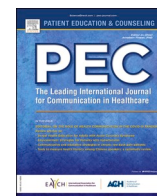
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Physician gaze shifts in patient-physician interactions: functions, accounts and responses

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ABSTRACT

Objectives: Physician gaze towards patients is fundamental for medical consultations. Physicians' use of Electronic Health Records (EHR) affects their gaze towards patients, and may negatively influence this interaction. We aimed to study conversation patterns during gaze shifts of physicians from the patient towards the EHR.

Methods: Outpatient consultations (N = 8) were eye-tracked. Interactions around physician gaze shifts towards the computer were transcribed.

Results: We found that physician gaze shifts have different interactional functions, e.g., introducing a topic switch or entering data into the EHR. Furthermore, physicians differ in how they account for their gaze shifts, i.e., both implicitly and explicitly. Third, patients vary in treating the gaze shift as an indication to continue their turn or not.

Conclusions: Our results suggest that physician gaze shifts vary in function, in how physicians account for them, and in how they influence the conversation. Future research should take into account distinctions when relating gaze to patient outcomes.

Practice implications: Physicians may be aware of the interactional context of their gaze behaviour. Patients respond differently to various types of gaze shifts. How physicians handle gaze shifts can therefore have different consequences for the interaction.

1. Introduction

Physicians' gaze behaviour is a fundamental aspect of consultations [1]. Physicians can use their gaze to direct the conversation and transmit social and attentional information towards patients [2–4]. For instance, when physicians turn their gaze towards the computer screen, patients tend to follow their gaze [5]. Moreover, physicians' gaze towards the patient is positively related to patient outcomes, such as their level of trust in the physician, adherence to medication prescriptions and even physical and cognitive functioning [6–9].

Physicians' use of Electronic Health Records (EHR) during the consultation is likely to affect their gaze behaviour toward patients. EHR were introduced to increase adherence to guidelines, enhance disease surveillance and decrease medication errors [10]. Yet, if EHR use leads to a decrease in gaze towards the patient, this may negatively influence the quality of the physician-patient interaction [11]. Outcomes of

studies on the effects of EHR-use on the quality of medical interactions are inconclusive. Some results suggest that physicians' EHR use during consultations does not negatively affect patient outcomes such as satisfaction with the physician [12,13]. Conversely, other studies found negative effects if physicians gazed more at the EHR, such as less discussion of psychosocial topics and fewer questions asked by the patients [5, 11, 14, 15].

To better understand what may cause these discordant findings, more insight is needed into what happens during and around the moments when physicians shift their gaze towards the computer [16]. A previous study suggests that when physicians gaze towards the computer screen, this may leave patients in the dark about whether the physician is listening [17]. Another study even argued that the computer can be seen as a third party in the interaction, resulting in a triangular rather than a two-way interaction [18]. Therefore, it is important to investigate the coordination of physician gaze with their speech, and the

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timing of their gaze shifts towards the computer. By zooming in on specific moments within this interaction, it is possible to study the direct interactional functions and consequences of physicians' gaze shifts from the patient to the screen. Such insights contribute to developing effective ways of interacting with the patient, needed to optimize physician's use of computers in the consultation room [19].

Conversation Analysis enables obtaining detailed insights in focused elements of specific social interactions [17,20]. In Conversation Analysis, each communication instance is interpreted as a joint action [20]. In particular, an interaction is interpreted as a sequence of social actions rather than isolated messages or propositions. By studying the interactional consequences of physicians' gaze shifts towards the computer, we can elucidate mechanisms of interaction that may have consequences for the conversation and the patient, and therefore the reported outcomes [17]. Conversations are constituted of turns and these again of turn constructional units, which is how orderly speaking normally takes place [21]. Turns are often organized in action pairs called adjacency pairs; for instance a question is usually followed by an answer [22]. In subsequent turns speakers show each other aspects of how the prior turn was understood. Focusing on these features of social interaction may elucidate both verbal and nonverbal mechanisms of patient-physician interactions.

Conversation Analysis can also be applied to nonverbal communication, such as illustrating how the physician gaze shifts towards the computer screen influence the patient-physician interaction [23]. With regard to gaze, Conversation Analysis studies show that during the closure of the consultation, gaze towards the computer may contribute to a quick closing progression. Thereby, last minute concerns of patients may have remained undisclosed [24]. By not gazing towards the patients, physician may show disengagement with regard to patient complaints [25].

Therefore, we aimed to study physicians' gaze shifts from the patient towards the computer screen using Conversation Analysis. In particular, we aimed to answer the following research questions: 1) What are the interactional functions of physicians' gaze shifts from the patient towards the computer?; 2) Do physicians account for their gaze shift towards the computer screen, and if so, how?; and 3) What is the patient's interactional response in adjacent turns?

2. Methods

2.1. Design and procedure

This is a conversation analytical study of observational data. The

data were extracted from an overarching data collection, obtained with the aim to understand the effects of physicians' gaze on the quality of the patient-physician relationship [16].

The study was conducted at the outpatient clinic of an Internal Medicine department at a Dutch academic hospital. First, physicians were included and signed informed consent. Patients were invited by the researcher to participate prior to their scheduled follow up consultation. Upon agreement, they signed informed consent. During the consultation, which was video-recorded, the physician's gaze was continuously registered using eye-tracking glasses.

Patients received a gift card of 15 euro for participation. In total 100 patients and 16 physicians participated in the study, of which this paper reports a sub-selection. Data collection started in February 2018 and ended in May 2019.

2.2. Participants

Participating physicians were residents in Internal Medicine. Physicians and patients were included who had not met each other prior to study participation. Therefore, we included the most important moment for rapport building, i.e., their first consultation [26]. To be eligible, patients had to speak Dutch fluently, be older than 18 years and be without serious mental illnesses. For the present analyses, eight consultations conducted by four different physicians were purposively selected. These involved four female and four male patients with a mean age of 56.5 years (range 40–66). Six patients were Dutch and two were from South America. Two patients had a lower education level (no schooling/primary school), five medium education (secondary/lower level vocational school) and one patient had a higher education level (college/university). To warrant privacy, all physicians and patients are referred to as "she/her".

2.3. Sample selection

We selected follow-up consultations concerning diabetes mellitus, because during these consultations the EHR is regularly consulted to check and discuss patients' blood test results. Furthermore, we limited our sample to conversations involving two participants, i.e., physician and patient. In total, eight consultations were selected for analysis. Transcription of interactions around gaze shifts started at the beginning of the consultation, when the physician and patient were both seated. Transcription of the interaction around gaze shifts stopped towards the end of the consultation, when the physician discussed the next appointment or asked the patient about any remaining questions. This

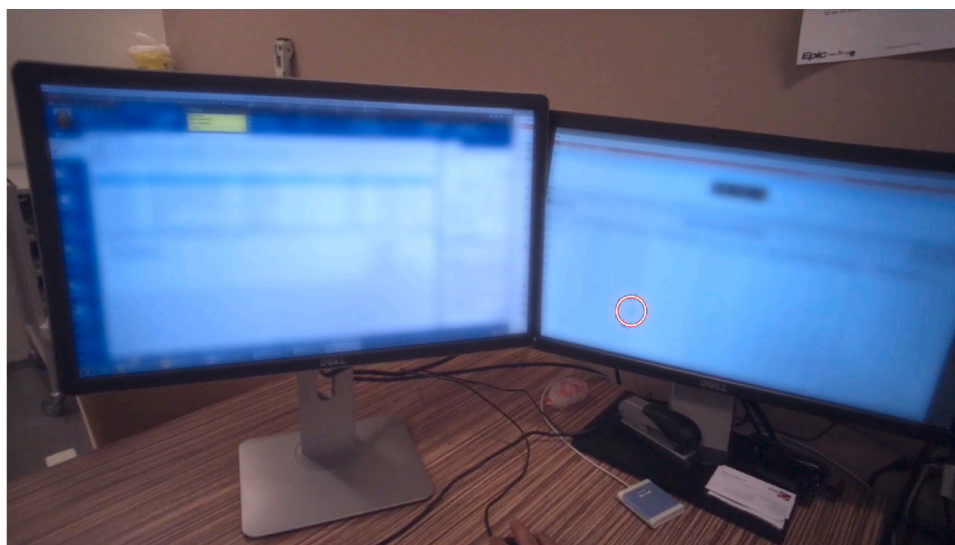


Fig. 1. Snapshot of eye-tracking data of physician gaze towards the Electronic Health Record. Note: The orange circle represent the gaze location of the physician.

resulted in a collection of 277 fragments involving a gaze shift.

2.4. Eye-tracking

The physician’s gaze was recorded using mobile eye-tracking. Eye-tracking enables capturing the exact and objective location of the wearer’s gaze [27]. For this purpose, the physician wore Tobii Pro Glasses 2 (Tobii Pro AB, Danderyd, Stockholm, Sweden). The Pro Glasses 2 are equipped with two cameras per eye (measuring the pupil size and movement) and a camera that records the environment. Fig. 1 depicts the gaze of the physician towards the computer screen. It illustrates how exact observation of gaze location is possible. Therefore, we were able to match gaze location exactly to the conversation analysis. The eye-tracking data, combined with the video recordings, were used to transcribe the gaze shift fragments, as shown in Appendix 1.

2.5. Video recording

We video-recorded the consultations to have a richer perspective for the Conversation Analysis, in addition to the eye tracking which records lower quality video and sound [28,29]. The video camera was positioned at shoulder height approximately 1.5 m from the patient and physician. The video registrations were used to analyse verbal communication.

2.6. Conversation analysis

Our collection of fragments includes all gaze shifts, i.e., every moment in which the physician changed his/her gaze from the patient towards the computer screen, and some fragments contain more than one gaze shift. These conversational instances were transcribed according to the Jefferson conventions [30,31], see Appendix 1. Details of the interaction, such as overlap and silences, are included in the transcript. Non-verbal acts are also shown, such as typing and clicking,

similar to the conventions of Mondada [32] (Appendix 1). In our transcripts, physician turns are indicated by: “Ph:”, and patient turns by “Pa:”. A turn is a unit of conversation analysis that corresponds to a stream of speech bounded by the speech of another [33]. We display the original Dutch turns, including the original transcription conventions, followed by an English translation.

3. Results

We identified different interactional functions and accounts of the physicians’ gaze shifts towards the computer screen and subsequent responses of patients. The different interactions were subdivided into four categories and several subcategories. The fragments shown in our result section are taken from six consultations.

3.1. Interactional functions of gaze shifts of the physician towards the computer screen

We observed three different interactional functions of physicians gaze shift towards the computer screen, divided over 266 fragments: 1) 144 fragments in which the physician enters data into the Electronic Health record (EHR), 2) 37 fragments in which the physician checks the information provided by the patient in the EHR, and 3) 85 fragments in which the physician retrieves information from the EHR to generate turns.

3.1.1. The physician enters data into the EHR

By turning towards the computer screen, physicians are able to enter information obtained during the consultation into the EHR. This function occurred in most gaze shifts in our sample. In the example below, patient and physician discuss that the patient cannot tolerate certain medication (531) and the physician inserts information into the EHR.

Fragment 1 – Consultation VI.

531	Pa:	>daar kan ik {daar kan ik< [absoluut echt niet tegen [ik krijg I can't I absolutely can't stand that it gives me
532	Ph:	{>PC
533	Ph:	[ja [nee yes no
534	Pa:	er eh (0.4) letterlijk roo- rooie #vlekken van uh literally re- red spots
535	→ Ph:	#C
536	Ph:	ja yes
537		##(10.8)
538	→	#T-----
539	Ph:	e:hm# en {beweging↑ doet u iets aan sport [of eh ehm and exercise do you do something like sports or eh
540		-----# {>P
541	Pa:	[ja ik doe [ik doe yes I do I do
542	Ph:	[ja yes

In lines 535, 538 and 540 the physician is clicking and typing. The moment the patient informs “I absolutely can’t”, the physician starts gazing towards the computer. In line 537 there is a long gap of 10.8 seconds during which the physician types. After the gap, the physician uses an and-preface (line 539) [34], which is used to link a question to a preceding question/answer pair. The physician treats the sequence as complete after typing and by using an and-preface the physician indicates that the preceding questions has a routine character. The patient then answers the question. The typing in line 538 reveals the function of looking towards the computer screen, i.e., entering information into the EHR.

3.1.2. The physician checks information provided by the patient in the EHR

A second interactional function of physicians' gaze shifts towards the computer is to gather patient data from the EHR and/or to check whether patients' provided information matches the data in the EHR. In the excerpt below the patient talks about her visit with the diabetes nurse, which is checked by the physician in the EHR.

Fragment 2 – Consultation I.

3.1.3. The physician retrieves information from the EHR to generate a turn

A third interactional function of physicians' gaze switches towards the computer screen is to generate a turn involving a topic change, as illustrated by the excerpt below. In this excerpt, the physician and patient discuss the patient's glucose levels. The physician advises to take note of the glucose levels to generate guidance for future insulin dosages before generating a topic switch.

624	Pa:	<u>en</u> dat vond ze wel eh: <i>and she thought that was uh</i>
625		(0.4)
626	Pa:	goed <i>good</i>
627		(0.3)
628	Ph:	{ [oke ja <i>okay yes</i>
629		{>PC
630	Pa:	[dat eh <i>that uh</i>
631	→ Ph:	<u>dat</u> [schrijft ze ook <i>she writes so too</i>
632	Pa:	[ik heb geen <u>blauwe</u> plek[ken {enzo <i>I don't have any bruises and stuff</i>
633		{>P
635	Ph:	[ja <i>yes</i>
636	Pa:	nee <i>no</i>

In line 624, the patient indicates that the diabetes nurse was satisfied with the condition of the insulin injection spot on the thigh by informing, "and she thought that was good". Subsequently, after a pause of 0.3 the physician shifts her gaze towards the computer (line 629) and she confirms "okay". The physician's "okay" overlaps with the patient's "that uh", which indicates that the patient treats the gaze shift as if the physician is looking for validation. The patient starts her turn by giving an account, i.e., in line 632 "I don't have any bruises". By initiating this account (line 630) the patient shows that she treats the gaze shift as a search for evidence from the physician, who confirms "she writes so too" (line 631). The physician thus indicates that the discussed information can be found in the EHR, and the patient can deduce that the physician was checking whether the information was registered.

Fragment 3 – Consultation III.

569	Ph:	dan (.) weet u de volgende {keer he {dan kunt u iets meer <i>then you'll know next time eh then you can inject a little more</i>
570		{>W {>P
571		of iets [minder spuiten {°en kunt u er rekening mee houden.° <i>or a little less and you can take that into account.</i>
572		{>PC
573	Pa:	[ja <i>yes</i>
574	Pa:	°ja° <i>yes</i>
575		(0.6)
576	→ Ph:	{hee met de ogen hoe is het daarmee <i>hey with the eyes how is that going</i>
577		{>P

In the sequences of fragment #3, the physician gives the patient an advice that the patient then accepts. When the advice of the physician is possibly complete (line 571) after “a little less” the physician shifts her gaze from the patient towards the computer. Thereby the physician shows that the advice is possibly complete, also affirmed by the pre-completion response of the patient in line 573. Also, the softly pronounced increment (“and you can take that into account”) indicates that the physician is consulting the screen at the same time [35]. The gaze shift from the screen towards the patient (line 577) simultaneously with the attention-getter “hey” and the introduction of a new topic via left dislocation [36] (line 576) show the patient that the topic has been retrieved from the screen. The question on how the patient’s eyes are doing constitutes a topic change.

3.2. How physicians account for their gaze shift towards the computer screen

We found there to be two ways in which physicians account for their gaze shift towards the computer that occurred in 253 fragments: 1) explicitly and 2) implicitly. The explicit accounts are subdivided into a) 9 fragments where the physician points towards the computer screen, b) 27 fragments in which the physician announces the gaze shift towards the computer screen, and c) 23 fragments in which the physician gives an implicit post gaze shift account. The implicit accounts were subdivided into a) 127 fragments in which the physician performs an action involving the computer, and b) 67 fragments in which the physician uses

information from the EHR in a turn.

3.2.1. Explicitly account for gaze shifts

a. The physician points towards the computer screen

In these instances physicians point towards the screen to support a shift in focus. This subcategory is one of the least occurring in our fragments. In the example below the physician and patient discuss the patient’s HbA1c value (an indicator of blood sugar levels). Earlier in the conversation, the physician turned the computer screen towards the patient, allowing the patient to see the information

displayed to which she is pointing.
Fragment 4 – Consultation IV

the excerpt below. Prior, the physician and patient discussed that the patient had not measured blood sugars for several weeks. After giv-

266	Ph:	ja weet u ehm #(0.3) ik denk dat we hier niet <u>al</u> te veel <i>yes you know um I think we should not attach too much</i>
267	→	#PO
268	Ph:	{waarde aan moeten hechten [{ <u>want</u> #kijk <u>deze</u> hoogste <u>punt</u> wa:s <i>value to this because look this highest point was</i>
269		{>P
270		{>PC
271	→	#PO-----
272	Pa:	[°ja° <i>yes</i>
273	→	(0.4)
274	→	Ph: -----
275	→	Ph: nouja (.) net (0.3) la- laten we zeggen zes <u>en</u> # <u>vijftig</u> . <i>well just about le- let's say fifty-six.</i>
276	→	-----#

In line 268, the physician focuses her gaze on the screen and requests, "look" while simultaneously pointing to the graph shown on the screen from line 271 on. With "because" (line 268) the physician indicates that the screen shows information, which forms an account for her assessment in lines 266-268. By directing the patient's attention towards the screen the physician clarifies that the information on the screen is about to be discussed with the patient.

b. The physician announces the shift towards the computer screen

Physicians sometimes explicitly announce their attention shifts towards the computer screen. The announcement precedes the activity the physician carries out with the computer, as illustrated in

ing an advice, the physician makes an announcement of turning towards the computer.

Fragment 5 – Consultation V

103	Ph:	dus u gaat <u>nu</u> overdag meten <i>so you are now going to measure during the day</i>
104	Ph:	en dan morgenochtend, <i>and then tomorrow morning,</i>
105	Pa:	ja <i>yes</i>
106	Ph:	zodat ze <u>toch</u> wat waardes eh heeft. <i>so that she still has some eh values.</i>
107	Pa:	{pre[cies. <i>exactly.</i>
108	Ph:	{>PC
109	→	Ph: [ik maak daar even een notitie van #hoor? <i>I'm just making a note about that okay?</i>
110		#C
111		(0.2)
112	Pa:	#ja <i>yes</i>
113	Ph:	#C
114	Ph:	(1.7)#{ (1.5)# #{ (7.2)# #{ (0.9){
115		{>K {>PC {>P {>K
116		#T-----# #R-----# #T-----

In line 107 the patient confirms, "exactly", while the physician turns towards the screen. In line 109 the physician offers an account to the patient explaining the just prior gaze shift (108), "I'm just making a note about that okay?" which is received with "yes" by the patient in line 112. The physician treats this as an acceptance by spending a total of 11.3 seconds typing on the computer (lines 113-116).

c. *The physician gives a post gaze shift account*

Physicians sometimes retrospectively clarify their gaze shift towards the computer screen. In these instances the physician does not explicitly explain the gaze shift, but the reason can be deduced from her post gaze shift account. In the excerpt below, the physician asks for the notebook in which the patient keeps track of her blood glucose levels. Before, the patient indicated that she has difficulties regulating the blood glucose levels. Thereafter, the physician refers to information seen on the screen.

Fragment 6 – Consultation II.

156	Ph:	{kunt u anders [het <u>boekje</u> eens laten {zien? maybe you can show me the notebook?
157	Ph:	{>TA {>PC
158	Pa:	[ja
159		yes
160	Ph:	#R-
161		(2.1)
162		-----
163	→ Ph:	hè want ik <u>zie</u> # {dat u op dit moment gebruikt u <u>een</u> tabletje eh because I can see that you are currently using a tablet
164		{>P
165		-----#

In this fragment, the physician makes a request (156) and starts gazing at the computer screen at the end of the request turn. In line 163, the physician accounts for the request by using the causal connective “because”, which refers to what the physician is seeing. The physician accounts for the request (line 164), with “I can see”, which refers to the activity of gazing towards the computer screen. Thus, the physician gives an implicit and retrospective account for the gaze shift.

Fragment 7 – Consultation IV

1154	Ph:	{>P
1155	Pa:	[en dan eh eh dat and then uh uh that
1156	Pa:	{geef ik <u>aan</u> (.) #dat hoort oo- ook {#hoeveel keer dat ik een I register that that a- also includes the number of times I've
1157	→ Ph:	{>PC #C {>K
1158	→	#T-----
1159	Pa:	hypo gehad heb of dat ik me niet lekker# {voel had a hypo or I'm not feeling well
1160	→ Ph:	-----# {>PC
1161		(0.4)

In line 1156, the patient starts a turn, while at the same time the physician starts gazing towards the computer screen. During further turn constructional units (TCUs) [21] of the patient in lines 1156 and 1159, the physician performs various actions with the computer: clicking and typing. From these actions, it can be understood that the physician is gazing at the computer screen to enter data into the EHR.

3.2.2. *Implicitly account for gaze shifts*

When physicians' gaze shift towards the computer screen becomes apparent only implicitly, patients need to deduce the reasons from their actions or turns.

a. *The physician performs an action involving the computer*

This category comprises all non-verbal actions that the physician executes involving the computer, including typing, clicking, scrolling and moving the screen. This category is the second most occurring category in our sample. By lack of any verbal explanation, the patient needs to guess why the gaze shift takes place and what the physician is doing. In the following example, the physician performs actions with the computer. Before this fragment the physician and patient discuss why the patient visits the hospital only once every six months and how the healthcare is organized during these months. Then, the physician start clicking and typing without verbal explanation.

b. *The physician uses information from the EHR in a turn*

Another implicit method for physicians to account for their gaze shift is using information from the EHR in their turns. Different from category 3.1.3 the turns implicitly explain the gaze shift, as in the

excerpt below. The physician explains there is an elevated infection-inflammatory parameter in the patient's blood before implicitly referring to information retrieved from the screen.

Fragment 8 – Consultation III.

3.4. How does the patient respond to the physician's gaze shift towards the computer screen

We found there to be four different ways in which patients responded to physicians' gaze shifts towards the computer, divided over 235 fragments: 1) in 86 instances the patient continues talking; 2) in 87 in-

901	Ph:	daar hadden we toen niet echt een idee (.) eh van waarom dat zo <i>we didn't really have a clue at the time uh of why</i>
902		<i>zou kunnen komen</i> <i>that could be</i>
903	Pa:	wat (.) in november bedoelt u of {de de laatste me- <u>≡</u> <i>what in November you mean or the the last me</i>
904	Ph:	{>PC
905	→ Ph:	<u>≡</u> in november <i>in November</i>
906		{was dat ja ja ja dus die die is eh {nou eh per ongeluk <i>that was yeah yeah yeah so that that is uh well uh by accident</i>
907		{>P {>PC

Line 903 shows an ambiguity for the patient, for which the patient requests a clarification from the physician. Subsequently, the physician turns her gaze to the screen, which in this sequential position is interpretable as looking for the answer to the patient's alternative (x or y?) question. After this, during the turn of the patient (line 903) in which she abruptly stops speaking after the physician's gaze shift in line 904, the physician repairs the problem with a new turn, responding to the patient's question, "in November" (lines 905 and 906). In accordance with the physician's overlap of the second part of the patient's question (the or-part) her "yeah yeah yeah" (906) treats the patient's question as a yes/no-interrogative [37]. Also here, the position of this response following the gaze shift to the computer screen makes the response interpretable as being derived from the screen.

3.3. There is no apparent interactional function and/or the physician does not account for the reason for a gaze shift

In some instances, 91 in total, there is no deducible function or method used by physicians to account for their gaze shift towards the computer. In these instances, the gaze shift remains unexplained to the patient, as illustrated in the excerpt below. This fragment occurs at the start of the consultation. Prior, the physician explained that the onset of diabetes complications would take 10–15 more years. There is no verbal or nonverbal explanation for the gaze shift of the physician.

Fragment 9 – Consultation III.

stances the patient starts talking; 3) in 53 instances the patient remains silent; and 4) in 9 instances the patient stops talking.

3.4.1. The patient continues the turn after the physician's gaze shift

In this category, patients complete their turn after physicians' gaze shifts towards the computer screen until their turn is possibly complete. In the excerpt below, the patient and the physician discuss the patient's visit to the ophthalmologist. After the gaze shift of the physician, the patient completes her turn.

Fragment 10 – Consultation I.

92	→ Pa:	ja nee {dat was me ook al gelijk {duidelijk geworden in die <i>gesprekken</i> <i>yes no that had already become clear to me from those conversations</i>
93	→ Ph:	{>PC
94	→ Ph:	{>P
95	Pa:	met die andere artsen van (1.4) je doet het nu [voor <i>with those other doctors like you are doing it now for</i>
96	Ph:	[ja yes
97	Pa:	later <i>later</i>

In line 93, the physician starts looking at the computer screen, while the patient is producing a turn, which is designed as confirming what the physician has said earlier ("yes no that had already become clear to me"). The physician shifts her gaze to the computer screen at the start of the patient's confirmation turn and does not account (either explicitly or implicitly) for her gaze shift, which therefore remains unexplained for the patient. After this, the physician and patient discuss the long-term diabetes complications and the physician does not shift the gaze towards the computer screen for another 387 lines.

295	Pa:	en de <u>week</u> daarop, <i>and in the following week</i>
296	Ph:	hmhm <i>hmhm</i>
297	Pa:	willen ze me {gelijk ope#re{ren, <i>they want to operate on me right away</i>
298	Ph:	{>PC {>T
299		#T-----
300		(0.7)
301		-----
302	→ Pa:	omdat# {ik {ze hebben me in de tijd #te veel <u>oogdruppels</u> gegeven <i>because I they gave me too many eye drops in that time</i>
303	→ Ph:	{>P {>PC
304		-----# #T-----
		--
305	Pa:	{maar# eh {het <u>hiel:p</u> niet <i>but uh it didn't help</i>
306	Ph:	{>K {>P
307		-----#

The patient produces a turn (295-305) in which she explains details about the plans of the ophthalmologist and gives an account for it in line 302. At the start of the patient's account, the physician shifts her gaze from the patient towards the computer screen. After the end of the patient's turn, the patient continues with a turn constructional unit (TCU) (line 305) without a pause, "but uh it didn't help". The patient does not treat the physician's gaze shift as a sign that the physician is no longer listening to the patient: by producing a new TCU the patient does not give an interactional indication that she treated the gaze shift as if the physician was unavailable to listen.

3.4.2. The patient takes the turn after the physician's gaze shift

In this category, the patient starts talking after the physician turns towards the computer screen, as illustrated in the excerpt below. Earlier in the interaction, the physician communicated that the blood tests indicated the patient is doing well and in this fragment, the physician asks if the patient is also feeling well. The patient initiates a turn while the physician gazes at the computer.

Fragment 11 – Consultation I.

519	Ph:	=gaat <u>het</u> met u ook goed? <i>are things good with you too?</i>
520		(0.4)
521	Pa:	↑ <u>j</u> awe:l ↑ <u>t</u> uurlijk <u>i</u> k voel mij lekker in mijn vel, <i>yes sure I am feeling well</i>
522	Ph:	oke. <i>okay</i>
523	Pa:	↑ <u>j</u> a: <i>yea</i>
524	Ph:	{mooi <i>good</i>
525		{>PC
526	→ Pa:	<u>j</u> a <i>yes</i>
527	→	(1.1)
528	→ Pa:	#{en als je <u>z</u> ulke resultaten hoort dan {wordt het <u>d</u> ubbel weer <i>and when you hear such results then it is double</i>
529	Ph:	{>K {>PC
530		#T-----

In this fragment the physician asks the patient a question (line 519), “are things good with you too?” and receives an answer (line 521) “yes sure I am feeling well”, which the physician treats as complete by using a third position closure “okay” (line 522). The patient confirms her answer with “yea”, which is again treated as complete by the physician, not only with “good” (line 524), but also by turning her gaze towards the computer and thus treating the question-answer activity as closed [35]. After a gap of 1.1 seconds (line 527), again the patient continues her answer and gives an account for it in line 528 “and when you hear such results then it is double”, while the physician is typing and gazing towards the screen. Thus, the gaze of the physician towards the computer, and the physicians actions performed with the computer, are an integral part of the conversation and do not keep the patient from taking the turn.

3.4.3. The patient does not take the turn after the physician's gaze shift

In this category, a silence occurs after physicians complete their turn and shift their gaze towards the screen. Prior to the excerpt below, the patient and physician talked about the patient's visit to the ophthalmologist, which was not recorded in the EHR. During the physician's actions with the computer, the patient remains silent.

Fragment 12 – Consultation I.

415	Ph:	nou dan {ga [ik even die gegevens opvragen [want well then I'm going to ask for that data because
416		{>P
417	Pa:	[hm [oke hm okay
418	Ph:	die heb ik {niet [want I don't have those because
419		{>PC
420	Pa:	[is goed. all right.
421	Ph:	dat wil ik dan wel graag zien, I'd like to see that then
422	Pa:	hmhm hmhm
423	Ph:	#ehm um
424		#C--
425		(2.5)
426		-----
427	Ph:	°oke° okay
428		-----
429	→	(6.8)#
430		-----#
431	Ph:	ga ik {alleen nog eventjes {uw bloeddruk meten? I am just briefly going to measure your blood pressure
432		{>W {>P

In line 415 the physician announces that she is “going to ask for that data”, which is endorsed by the patient by “okay” (line 417). The physician then accounts for her announcement with “I don’t have those because” (line 419) during which she shifts her gaze towards the computer screen, nonetheless the patient confirms again with “all right” (line 421). The physician then interacts with the computer with “um” and with clicking, which can be seen as asking for information (first position). The patient’s silence (line 425) can be interpreted as a consequence of this: the patient may be waiting for the continuation. With “okay” (line 427) the physician may have received the information (third position). There is opportunity for a turn transition by the patient, which is not used. Given the 6.8 seconds gap, during which the physician is clicking, the patient treats this interaction as unavailability of the physician.

3.4.4. The patient stops the turn after the physician's gaze shift

In other instances, patients stop their turn after physicians' gaze shift, as illustrated below. This category is one of the least occurring ones. Prior to this excerpt, the physician and patient talked about losing weight. When the physician gazes towards the computer, the patient interrupts her turn.

Fragment 13 – Consultation V.

responded to gaze shifts. For example, patients either continued or stopped their turn after physicians' gaze shifts, meaning that patients may interpret physicians' gaze shift as an indication not to continue their turn. Thus, the computer is treated as a third participant in the consultation room, resulting in a triangular interaction [18].

Our study shows that patients may treat physicians' gaze shifts differently. When a patient does not complete a turn after a gaze shift of the physician, this can be labelled as dysfluency in the patient's reaction

1211	Pa:	<u>precies</u> maar ik ben op de sportschool en zo, <i>exactly but I'm going to the gym and stuff</i>
1212	Ph:	ja <i>yes</i>
1213		(0.7)
1214	→ Pa:	maar door di:e <u>urine</u> verlies{, <i>but because of that urine loss</i>
1215	→ Ph:	{>PC
1216	Ph:	#ja <i>yes</i>
1217		#S-
1218		(0.7)
1219		-----
1220	Pa:	al ga ik# eh even <i>if i go uh for a while</i>
1221		-----#
1222	Ph:	{ja <i>yes</i>
1223		{>P
1224	Pa:	<u>drie</u> minuten { [train#en? <i>train for three minutes</i>
1225		{>PC
1226		#C

In line 1214, the patient starts a new TCU "but because of that urine loss". During this TCU, the physician's gaze shifts towards the computer screen (1215). The patient immediately stops her turn and leaves her TCU audibly incomplete. This suggests the patient treated the physician's gaze shift as an indication not to continue the explanation. When the physician verbally responds to the patient's TCU with "yes" (line 1216), without taking her eyes off the computer, the patient continues with a new TCU "if I go uh for a while", possibly preferring self-repair over other-repair [38].

4. Discussion and conclusion

4.1. Discussion

We investigated conversation patterns during physician's gaze shifts towards the computer to better understand their impact on physician-patient interactions. Our conversation analytic results of these interactions revealed different types of gaze shifts, varying in several aspects, such as function or how they influence the interaction. We distinguished different functions of gaze shifts towards the computer of the physician. Furthermore, physicians sometimes accounted for their gaze shifts in explicit ways, similar to what has been found in previous research on how physicians manage their computer use while interacting with patients [39]. In other instances, gaze shifts were implicitly accounted for. Importantly, we found variation in how patients

[17]. Whenever a dysfluent reaction occurs this symbolizes that the physician's gaze disengagement is perceived as problematic leaving the patient in the dark about whether the physician is listening [17]. A previous study argued that it is important to coordinate speech and gaze when disengaging from interaction [17]. Yet, our study shows that even when speech and gaze are not aligned, e.g., when the physician only implicitly accounts for a gaze shift, often the patient continues or even starts a turn. Future research should investigate the link between the methods of explaining gaze shifts and the patient's consequent reactions, since it may influence self-disclosure of patients and consequently, physicians diagnostic ability [40]. Furthermore, it would be relevant to investigate whether there are any particular social actions preceding a gaze shift of the physician. For example, when the physician reads information on the computer screen it would be valuable to systematically analyse the specific social actions that lead to this event. This

would help to understand which implicit ‘rules’ [41] are inherent to patient-physician interactions.

Our results show that different instances of physicians’ gaze shift towards the computer bring about different meanings and consequences for the interaction with their patient. Because the physician is in charge of the computer, he/she may direct the consultation using gaze and other (non)verbal means [42]. For example, in many instances the physician performed actions with the computer, such as data insertion in the EHR, without explicitly explaining why. Furthermore, the in depth analysis of our data illustrates that a generic approach to gaze and the interactional effects of Electronic Health Record (EHR) use may not do justice to the complexity of gaze shifts. We found a variety in interactional functions and consequences in gaze shifts. Many studies approach gaze of the physician as being unidimensional, e.g. by grouping the moments the physician is either gazing towards the patient or not [16]. This may have led to incongruent findings where the consequences of the gaze behaviour diverged from more to less trust of the patient in the physician [16,43]. Consistent with this line of thought, a previous study hinted that there may be differential gaze patterns with differential consequences for patient-physician interaction outcomes such as (dis) engagement [44]. Therefore, a more nuanced, interactionally grounded approach to studying gaze shifts towards the computer confers particular advantages over a pre-categorized coding of gaze shifts. Such bottom-up approaches can help to characterize the phenomenon, enriching top-down coding [45].

Our study has limitations. We did not register the patient’s gaze. Previous studies show that gaze is interdependent between two interactors [5,46]. Therefore, it would be interesting to see whether the physician’s gaze shifts are in response to the patient’s gaze, or whether there are other reasons behind the gaze shifts [47]. Similarly, it would be of interest to analyse how the body orientation in combination with the gaze of physicians affects the attention and responses of patients, as previous research has shown that this affects the interaction [24]. Furthermore, it would be useful to replicate our study on a different sample, such as in a different specialism, or in long lasting patient-physician relationships, to see whether there are interactional functions of gaze shifts that did not occur in our sample.

Our study also has strengths. We have used eye-tracking to register the gaze of the physician, an innovative approach in conversation analysis, which can be seen as an addition with respect to data quality [48,49]. Eye-tracking enables more precise gaze registration, essential for accuracy of transcriptions, compared to earlier studies using video recordings and manual assessment of gaze [17,27].

Appendix 1. Transcription conventions

Symbol	Explanation
(.)	A silence lasting 0.2 s or less.
(0.5)	A silence for the duration of the number of seconds indicated.
text=	There is no discernible silence between the consecutive turns of speakers.
=text	
[text	Two speakers start producing a turn simultaneously.
[text	
te[xt	The second speaker starts halfway through the first speaker’s turn.
[text	
.	Falling intonation at the end of the utterance.
,	Slightly rising intonation.
?	Strongly rising intonation at the end of the utterance.
↑	The tone goes up for the duration of the syllable.
↑text↑	The tone goes up for the duration of the utterance between the arrows.
text	The underlined syllable or sound is accentuated.
°text°	The text between “°” is spoken relatively soft.
te-	The speaker abruptly stops production of a word or utterance.

(continued on next page)

4.2. Conclusion

In conclusion, we found important differences in the interactions around physician gaze shifts. Our results have consequences for quantitative research investigating physician gaze and patient reported outcomes such as trust or satisfaction. Such quantitative inquiries should make an in depth analysis of the gaze behaviour, providing a qualitative basis for coding decisions. Furthermore, it could be important for clinicians to explicitly align their gaze shifts with their speech, although quantitative research would need to confirm this.

4.3. Practice implications

This study serves to make physicians aware of the interactional context of their gaze behaviour. Gaze shifts have different functions and physicians vary in how they account for them. Furthermore, patients react differently to gaze shifts and may perceive a gaze shift as an unavailability of the physician’s attention. Possible consequences of dysfluency in physician attention could be, for instance, a negative influence on patient outcomes such as satisfaction. Our results can be used to inform physician communication skills trainings.

CRedit authorship contribution statement

Chiara Jongerius: Conceptualization, Data curation, Investigation, Methodology, Project administration, Writing – original draft. **Marij A. Hillen:** Conceptualization, Funding acquisition, Resources, Supervision, Writing – review & editing. **Johannes A. Romijn:** Conceptualization, Funding acquisition, Resources, Supervision, Writing – review & editing. **Ellen M.A. Smets:** Conceptualization, Funding acquisition, Supervision, Writing – review & editing. **Tom Koole:** Conceptualization, Investigation, Formal analysis, Methodology, Supervision, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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(continued)

Symbol	Explanation
<i>text</i>	The English translation of the original Dutch text.
Gaze	Explanation
{	Indicates where a gaze change takes place relative to the spoken text.
>P	Looks at the patient.
>Ph	Looks at physician.
>PC	Looks at the computer screen.
>K	Looks at the keyboard.
>W	Looks at the wall.
>TA	Looks at the table.
Non-verbal com.	Explanation
#	Indicates the place in the utterance where the physician begins and ends with a non-verbal action related to the computer.
#T	Types.
#C	Clicks.
#S	Scrolls.
#R	Reads information on the computer screen.
#PO	Points out information on the computer screen.

References

- MacDonald K. Patient-clinician eye contact: social neuroscience and art of clinical engagement. *Postgrad Med* 2009;121(4):136–44.
- Kleinke CL. Gaze and eye contact: a research review. *Psychol Bull* 1986;100(1):78.
- Freeth M, Foulsham T, Kingstone A. What affects social attention? Social presence, eye contact and autistic traits. *PloS One* 2013;8(1):e53286.
- Jokinen K, Harada K, Nishida M, Yamamoto S, editors. Turn-alignment using eye-gaze and speech in conversational interaction. Eleventh Annual Conference of the International Speech Communication Association; 2010.
- Montague E, Asan O. Dynamic modeling of patient and physician eye gaze to understand the effects of electronic health records on doctor–patient communication and attention. *Int J Med Inform* 2014;83(3):225–34.
- Hillen MA, de Haes HC, van Tienhoven G, Bijker N, van Laarhoven HW, Vermeulen DM, et al. All eyes on the patient: the influence of oncologists' nonverbal communication on breast cancer patients' trust. *Breast Cancer Res Treat* 2015;153(1):161–71.
- Mikesell L. Medicinal relationships: caring conversation. *Med Educ* 2013;47(5):443–52.
- Gorawara-Bhat R, Dethmers DL, Cook MA. Physician eye contact and elder patient perceptions of understanding and adherence. *Patient Educ Couns* 2013;92(3):375–80.
- Ambady N, Koo J, Rosenthal R, Winograd CH. Physical therapists' nonverbal communication predicts geriatric patients' health outcomes. *Psychol Aging* 2002;17(3):443.
- Chaudhry B, Wang J, Wu S, Maglione M, Mojica W, Roth E, et al. Systematic review: impact of health information technology on quality, efficiency, and costs of medical care. *Ann Intern Med* 2006;144(10):742–52.
- Margalit RS, Roter D, Dunevant MA, Larson S, Reis S. Electronic medical record use and physician–patient communication: an observational study of Israeli primary care encounters. *Patient Educ Couns* 2006;61(1):134–41.
- Alkureishi MA, Lee WW, Lyons M, Press VG, Imam S, Nkansah-Amankra A, et al. Impact of electronic medical record use on the patient–doctor relationship and communication: a systematic review. *J Gen Intern Med* 2016;31(5):548–60.
- McGrath JM, Arar NH, Pugh JA. The influence of electronic medical record usage on nonverbal communication in the medical interview. *Health Inform J* 2007;13(2):105–18.
- Asan O, Smith D, Montague P, More E. screen time, less face time–implications for EHR design. *J Eval Clin Pract* 2014;20(6):896–901.
- Shachak A, Reis S. The impact of electronic medical records on patient–doctor communication during consultation: a narrative literature review. *J Eval Clin Pract* 2009;15(4):641–9.
- Jongerius C, Twisk JW, Romijn JA, Callemeyn T, Goedemé T, Smets EM, et al. The influence of face gaze by physicians on patient trust: an observational study. *J Gen Intern Med* 2021;1–7.
- Ruusuvuori J. Looking means listening: coordinating displays of engagement in doctor–patient interaction. *Soc Sci Med* 2001;52(7):1093–108.
- Herijgers MM, van Charldorp TT, Maat HHP. Human-human-computer triads in institutional encounters. *J Pragmat* 2019;150:1–16.
- Frankel R, Altschuler A, George S, Kinsman J, Jimison H, Robertson NR, et al. Effects of exam-room computing on clinician-patient communication. *J Gen Intern Med* 2005;20(8):677–82.
- Garfinkel H. *Studies in ethnomethodology*. Englewood cliffs. Y. Prentice-Hall; 1967.
- Selting M. On the interplay of syntax and prosody in the constitution of turn-constructural units and turns in conversation. *Pragmatics* 1996;6(3). 371–88.
- Goodwin C, Heritage J. *Conversation analysis*. *Annu Rev Anthropol* 1990;19(1):283–307.
- Maynard DW, Heritage J. Conversation analysis, doctor–patient interaction and medical communication. *Med Educ* 2005;39(4):428–35.
- Park Y. Negotiating last-minute concerns in closing Korean medical encounters: the use of gaze, body and talk. *Soc Sci Med* 2013;97:176–91.
- Robinson JD. Getting down to business: talk, gaze, and body orientation during openings of doctor-patient consultations. *Hum Commun Res* 1998;25(1):97–123.
- van Dulmen AM, Verhaak PF, Bilo HJ. Shifts in doctor-patient communication during a series of outpatient consultations in non-insulin-dependent diabetes mellitus. *Patient Educ Couns* 1997;30(3):227–37.
- Jongerius C, Hessels RS, Romijn JA, Smets E, Hillen MA. The measurement of eye contact in human interactions: a scoping review. *J Nonverbal Behav* 2020.
- Dindar K, Korkiakangas T, Laitila A, Kämä E. An interactional “live eye tracking” study in autism spectrum disorder: combining qualitative and quantitative approaches in the study of gaze. *Qual Res Psychol* 2017;14(3). 239–65.
- Falck-Ytter T, von Hofsten C, Gillberg C, Fernell E. Visualization and analysis of eye movement data from children with typical and atypical development. *J Autism Dev Disord* 2013;43(10):2249–58.
- Jefferson G. Glossary of transcript symbols with an introduction. *Pragmat Beyond N Ser* 2004;125:13–34.
- Mazeland HJ. *Inleiding in de conversatieanalyse*: Coutinho; 2003.
- Mondada. Conventions for multimodal transcription. https://franzoesistik.philhist.unibas.ch/fileadmin/user_upload/franzoesistik/mondada_multimodal_convention_s.pdf 2016.
- Crookes G. The utterance, and other basic units for second language discourse analysis. *Appl Linguist* 1990;11(2):183–99.
- Heritage J, Sorjonen M-L. Constituting and maintaining activities across sequences: and-prefacing as a feature of question design. *Lang Soc* 1994;23(1):1–29.
- Rossano F. Gaze in conversation. *The handbook of conversation analysis*. Wiley-Blackwell; 2013. p. 308–29.
- Ross JR. Constraints on variables in syntax. Massachusetts Institute of Technology; 1967.
- Raymond G. Grammar and social organization: yes/no interrogatives and the structure of responding. *Am Sociol Rev* 2003;939–67.
- Schegloff EA, Jefferson G, Sacks H. The preference for self-correction in the organization of repair in conversation. *Language* 1977;53(2). 361–82.
- Nielsen SB. How doctors manage consulting computer records while interacting with patients. *Res Lang Soc Interact* 2016;49(1):58–74.
- Duggan AP, Parrott RL. Physicians' nonverbal rapport building and patients' talk about the subjective component of illness. *Hum Commun Res* 2001;27(2):299–311.
- Robinson JD. The role of numbers and statistics within conversation analysis. *Commun Methods Meas* 2007;1(1):65–75.
- Greatbatch D, Heath C, Campion P, Luff P. How do desk-top computers affect the doctor-patient interaction. *Fam Pract* 1995;12(1):32–6.
- Thom DH. Physician behaviors that predict patient trust. *J Fam Pract* 2001;50(4):323.
- Asan O, Young HN, Chewning B, Montague E. How physician electronic health record screen sharing affects patient and doctor non-verbal communication in primary care. *Patient Educ Couns* 2015;98(3):310–6.
- Stivers T. Coding social interaction: a heretical approach in conversation analysis? *Res Lang Soc Interact* 2015;48(1):1–19.
- Pfeiffer UJ, Vogeley K, Schilbach L. From gaze cueing to dual eye-tracking: novel approaches to investigate the neural correlates of gaze in social interaction. *Neurosci Biobehav Rev* 2013;37(10):2516–28.
- Schegloff EA, Sacks H. Opening up closings. *Semiotica* 1973;8(4).
- Auer P. Turn-allocation and gaze: a multimodal revision of the “current-speaker-selects-next” rule of the turn-taking system of conversation analysis. *Discourse Stud* 2021;23(2):117–40.
- Parry RH, Land V. Systematically reviewing and synthesizing evidence from conversation analytic and related discursive research to inform healthcare communication practice and policy: an illustrated guide. *BMC Med Res Methodol* 2013;13(1):1–13.