Neurological Examination in Telemedical Consultations in Stroke Diagnosis. Multimodal Practices of Computer-Mediated Collaboration[2]

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Abstract

Over the past years, the importance of telemedicine has increased considerably for patient care, also in Germany. In the case of acute neurological symptoms, telemedical consultations between rural clinics and expert neurologists in medical centres may shorten the door-to-needle time and contribute to a suitable treatment decision. Using methods of multimodal conversation analysis, we examine the interplay of talking, examining, and professional perceiving in a triadic face-to-screen and face-to-screen constellation of telemedical stroke consultations. The multimodal and multimedia practices used by the participants within the collaborative engagement in neurological testing are the central issues of the current study.

Keywords*:* Telemedicine, Video Consultation, Neurological Consultation, Multimodality, CMC, Conversation Analysis

1 Introduction

Telemedicine is not only gaining ground because of the growing technological possibilities. It is driven by the guiding principle of bundling medical expertise in large specialist centres, based on models such as Denmark. Another aspect is the economic considerations of clinics in rural areas, which lead to closures, and the great distances to medical centres that make it difficult to provide comprehensive care for patients. In outpatient care, e.g., rehabilitation medicine, telemedical consultation hours can maintain contact with patients with restricted mobility and support rehabilitation. In the coronavirus pandemic, further advantages of telemedicine have become clear: It can prevent medical care facilities from becoming outbreak sites of infectious diseases by avoiding direct contact between medical staff and patients through the use of communication media.

[2] This paper has been published in German as „Die neurologische Untersuchung in telemedizinischen Konsultationen zur Schlaganfalldiagnostik: Multimodale Praktiken medial vermittelter Kollaboration**.** *In:* Sprache im Beruf 3(2) (2020), 109-141, doi:10.25162/sprib-2020-0007.

Also in emergency care, telemedicine is becoming increasingly important, especially in rural areas without comprehensive medical care. That led to the development of TEMPiS "Telemedical Project for Integrated Stroke Care in the Region of South-East Bavaria" (http://www.tempis.de, accessed on October 29, 2023) in 2003. Twenty-five hospitals in southeast Bavaria are connected to the TEMPiS network and receive a teleconsultation service from the two Stroke Centers of the *Medbo district clinic* in Regensburg and the *Munich clinic Harlaching*. Both are consulted around 10,000 times a year. In teleconsultation, experienced specialists for "vascular neurology" connect via video conference calls to perform an anamnestic and neurological examination of the patient to make recommendations for further treatment. A stroke requires immediate medical attention and, depending on whether the cause is bleeding or an occlusion. In the case of the latter, treatment with thrombolysis, i.e., the administration of blood-thinning medication is indicated. According to the dictum "time is brain," there is only a short period of approximately four to five hours for the so-called "lysis therapy" to prevent permanent brain damage. In case of bleeding, however, this treatment would be fatal. To avoid incorrect treatment, neurological consultations are mandatory before the use of lysis therapy.

The current study is based on data obtained from telemedical neurological consultations in the event of a suspected stroke. In these interactions, there is a continuous triadic participation structure of neurologists connected via video as telemedic (TM), on-site treating physician (LD for local doctor) and the patient (P), thus involving face-to-screen (TM and LD/P) and face-to-face constellations. The diagnostic process involves exploring the symptoms and a physical, neurological examination of the P by the TM, which requires instrumental and/or physical access to the patient. The solution to this dilemma lies in the involvement of the treating hospital doctors. They take on assistance functions in a collaborative participation constellation (for assistance as a form of cooperative engagement, see Zinken/Rossi 2016). This paper focuses on the unique requirements that arise for those involved and how they meet them. Section 2 gives a brief insight into telemedicine, and outlines the state of research in conversation analysis. Section 3 explains the study, the questions and the methodological approach (3.1) and gives an overview of the data corpus used (3.2). Section 4 embeds the activity of the neurological examination within the triadic consultation before section 5 presents the analysis results. The article closes with a comprehensive discussion in section 6.

2 State of Research: Telemedicine in Conversation Research

Telemedicine is part of what the World Health Organization (WHO) calls e-health. The latter is defined as follows: "eHealth is the use of information and communication technologies (ICT) for health." (Jorzig/Sarangi 2020: 96, cf. a. https://www.who.int/ehealth/en/; accessed on October 29, 2023). It includes public health monitoring, patient administration, training of medical staff and health services research, etc. While a lot of it is unquestionably indispensable, the treatment of patients is still met with reservation, especially in Germany, where the so-called "remote treatment ban" was only lifted in 2015. However, personal contact remains prioritized, and the use of communication media is assigned a subsidiary role.

Telemedicine has proven to be particularly valuable in multidisciplinary teams. The meta-study by Aghdam/Vodovnik/Hameed (2019) on articles found with the search terms "telemedicine" and "multidisciplinary team" in the PubMed database shows the advantages of telemedicine over traditional settings in a wide range of specialist disciplines. They lie in the practical and tailor-made patient care, as collaboration and medical expertise increase and diagnosis, treatment, and follow-up treatment are improved regardless of their location. In the acute medical field, such as in stroke care, telemedical consultations also shorten the transfer of information. In emergencies, they help ensure adequate patient care quickly and over a distance. They shorten the so-called *door-to-needle time* (cf. Bergrath/Czaplik 2016).

Medical conversation analysis does not question the importance of personal relationships, it rather confirms the relevance of the doctor/patient conversation to develop a stable relationship of trust, which is a prerequisite for successful treatment (Birkner 2017). However, concerning the question of how mediatization affects the interaction and participation in the doctor/patient conversation, research in conversation analysis is still limited. Closing the gap is generally seen as a desideratum (cf. Miller 2011; Pappas et al. 2019, Pappas/Seale 2009, Seuren 2020). On the one hand, that involves fundamental research on the conditions and requirements of mediatized interactions, on the other hand, from an applied linguistic perspective, it enables the development of training material and the foundation of the training of medical staff (Beul 2013).

In a comparison of face-to-face and video-mediated consultations with postoperative cancer patients for injury control and discussion of histological findings, Stommel et al. (2020) show that the use of conversational actions in video consultations may be adapted to the possibilities of mediatization. They find that the "How are you" question is used significantly more frequently in opening video consultations than in the face-to-face corpus. It receives functions on the relational level that are fulfilled differently in face-to-face consultations, for example, through small talk, when the interactions begin with calling in the patient from the waiting room and then going to the treatment room together, etc. In video consultations, interactions start with a check of the internet connection. In face-to-face conversations, "How are you" opening questions are treated as establishing ambiguous response relevancies between a medical and a mundane agenda (Groß 2018, Boluwaduro/Groß 2019). Stommel et al. (2019) argue that this ambiguity may be used systematically in teleconsultations to serve phatic communication. In this context, the "How are you?" question expresses other-attentiveness in a particular way (Stommel 2019: 287), while at the same time, its relevance to health makes it thematically connectable to the main topic of histological findings.

Another study on the same corpus examines the wound control process (Stommel/van Goor/Stommel 2020). While the doctors in the face-to-face situation have the wound shown (15 out of 17 cases), in the video consultations, they rely more frequently on the verbal descriptions of the patients (19 out of 22 cases). It becomes clear that the final assessment is achieved differently depending on mediatization. The patients play a fundamentally different role in the video consultation since their descriptions are treated as sufficient for assessing the healing process.

The adjustments that teleconsultations require include specific visibility management (Lanwer 2019: 107), with which co-presence is constantly processed and secured under the conditions of video communication. Physical examination at a distance is challenging for those involved; consequently, video consultations tend to be the exception for acute concerns. They require assistance, e.g., from another doctor or medical staff on site. Seuren, et al. (2019) examined seven video consultations of patients with heart failure and community nurses over FaceTime, during which check-ups were carried out. The authors describe recurring problems when

patients are instructed to carry out the examination (e.g., blood pressure measurement, etc.) independently in such a way that visibility for the nurses via video is ensured at the same time. Seuren, et al. conclude, that the development of a training course is necessary before implementing this pilot project, as well as the exploration of further possible challenges for various patient groups.

Pappas et al. (2019) examine multi-party video consultations of patients, nurses, specialists, and general practitioners during diagnosis and therapy decisions. They conclude that the professionals are very well versed in dealing with the various modes of interaction and switching between consultation and inter-professional exchange. But while nurses feel comparatively empowered, patients show very little participation in these conversations (cf. also Pappas/Seale 2009). However, it is difficult to determine whether this is due to the video setting or the overrepresentation of the intra-professional institutional representatives.

So far, there are no indications of fundamental and insurmountable interactive hurdles in the implementation of teleconsultations. Lanwer (2019), who compared conventional telephony and video telephony, observes that in mundane video conversations, the interlocutors coordinate their actions as a virtual co-presence and simulate the visual reciprocity of the face-to-face situation. The same is likely to apply to medical video consultations, even if the requirements and procedures for successfully dealing with virtual presence still need to be explored.

3 Data and Methods

In the following, we present the methodology and the questions as well as the data collected.

3.1 Data Corpus and Setting

The data of the study consists of 34 consultations recorded between 12/2014 to 5/2015 at TEMPiS in the Munich Clinic Harlaching. The conversations usually last between ten and twenty minutes. In our study, we considered only responsive patients capable of giving their consent.

3.1.1. The Recording Situation

The conversations were recorded in Munich in the TEMPiS rooms with an additional camera. It is positioned next to the TM with a view of the three-part screen; this way, it quasi-assumes the perspective of the TM. Figure 1 illustrates this:

Figure 1: The Camera Perspective of the TM.

The TM can be seen on the right-hand side of the picture aligned with the three-part computer screen. He is only partially captured by the recording but is visible in the front of the middle screen in the small window. The left of the three screens makes the current computer tomography image available. On the right screen, the examination is documented on a form that the TM fills out during the examination or afterwards. The video from the hospital is broadcast in the middle of the three screens. In the large section, you can see the patient positioned centrally opposite the camera, lying on a bed. On the right edge of the picture is the LD holding the documents in her hands. In the small section at the top left of this screen, the TM can be seen as he is transmitted to the affiliated hospital by the camera attached to a frame above the screen. Under the computer screen, one can see controls that operate the camera (zoom and pan).
Figure 2 shows a view of the opposite side.[3]

[3] This opposite view comes from an information film on the TEMPiS homepage and thus from a different recording situation. The data corpus of the project has so far only consisted of recordings from Munich Harlaching; Recordings from the widely scattered network of affiliated hospitals are not available.

Figure 2: The view inside the hospital (Source: Tempis.de).

There is only a single screen mounted on a frame with the camera; it is filled almost entirely by the head and part of the shoulder area of the TM. Here, too, the usual monitor window in the upper left edge shows the transmitted image, but it is probably not recognizable in detail for those present due to the distance. The patient lies on a hospital bed positioned in front of the screen and camera, with the treating LD sitting beside it.

In this triadic participant constellation between a) LD and b) P in the regional hospital and c) the TM, sometimes family members of the P or other hospital staff are present, too.

3.2.2 The Neurological Examinations

For differential diagnosis, several neurological tests are carried out within these telemediated consultations. The most common tests are:

- Eye Tracking Test

A finger (or an elongated object) is moved back and forth horizontally and vertically in front of the patient's face to check the eye movements. The P should follow the movements with his gaze.

- Field of View Test

This test checks the extent of peripheral vision in the right and left edge areas of the eyes. To do this, the doctor gradually brings his arms into the field of vision from behind, and P should announce the point at which they will be perceptible in the periphery of the field of vision.

- Sensor Test

To check whether both halves of the body perceive contact equally, the doctor lightly strokes both sides of the body with the hands.

- Motor Function Test

The P is asked to make precise facial movements, e.g., squinting the eyes or sticking the tongue out to test whether all facial muscles move easily and symmetrically. Checking the symmetry of the muscle strength in the patient's arms provides indications of neurological impairment.

- Gait Test

The P is asked to walk up and down in a straight line in the examination room.

Depending on the course of the examination, additional tests are occasionally carried out, but these will not be relevant to the present study.

3.2 Questions and Analytical Procedure

The conversations were transcribed entirely according to the GAT2 conventions (Selting, et al. 2009). In the analytical process, the primary verbal transcriptions of selected sequences were gradually refined in a multimodal manner, using stills of significant moments of the interactional conduct (Stukenbrock 2009). The published transcripts are focused on the aspects studied and adapted to the requirements of anonymization.

The conversations were analysed according to the theoretical-methodological principles of conversation analysis (Birkner et al. 2020), taking into account previous findings from medical conversation research (e.g., Busch/Spranz-Fogasy 2015) and multimodal conversation analysis (Mondada 2011). We aimed to capture the participation structure during the conduction of neurological testing (see section 4). Therefore, our analysis focuses on the complex verbal, bodily, instrumental and media-oriented actions of the three participants TM, P and LD as a step-by-step, coordinated construction of joint action (e.g., Haddington 2014, Deppermann 2018, Mondada 2018). First, we ask about the nature of these practices, second, about the tasks they have to overcome, and, third, about potential hurdles that arise, among other things, due to computer-based mediatization.

4. The Neurological Examination as part of the Teleconsultations

Before turning to the internal activity structure of the telemedical consultations, it is worth mentioning that they are part of a more complex consultation process. It begins with a call from the LD in the specialist centre to the TM. During this call, the first reports are transmitted, and the

telemedical consultation appointment is agreed upon. The diagnosis and therapy planning then occur in the next step or are deferred to telephone calls between TM and LD, supplemented by written documents and CT images. Figure 3 shows the course of the three phases of the overall consultation:

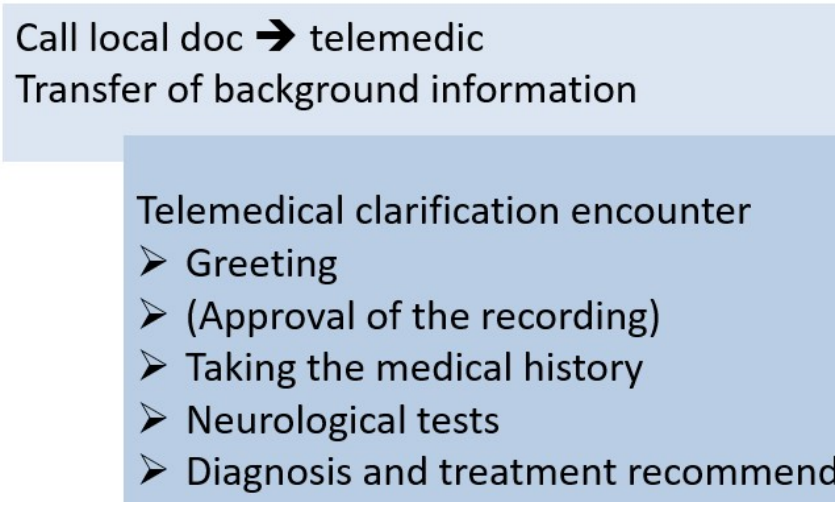

Figure 3: Schematic Representation of the entire consultation process.

The TM and LD are involved in all phases, but the P is only present in the telemedical consultations (=Telemedical clarification encounter), which represent the middle part of the three-step procedure. The neurological examination for diagnosis takes place at this point. Thus, the whole consultation process is divided into clearly delimited interaction events. Verbal references to the previous and next conversations occur, but the process is self-contained and characterized by specific participation.

The telemedical consultation, as documented in the data corpus, begins with the greeting which – due to the data collection – is usually connected to the approval of the recording. It is followed by an anamnesis in which the TM asks the P, among other things, about the type of complaints and the temporal development of the occurrence of the symptoms. Subsequently, the neurological examination is conducted. With the help of the neurological tests described above and the imaging procedures, it should be clarified whether there is a neurological cause for the symptoms described, especially a stroke. A diagnosis and treatment decision, on the other hand, do not always occur, though pre-diagnostic statements are uttered regularly (cf. Spranz-Fogasy 2014). In addition, the TM carries out written documentation.

At the end of the conversation, get-well wishes for the P are uttered, and, if necessary, appointments are made about the next steps with the LD.
Since our analysis focuses on the conversational practices that interlocutors use to perform the tests, the neurological examination within teleconsultations will be described in more detail. The overarching conversational tasks which the interlocutors face in the activity of the neurological examination include:

- initiating,
- performing,
- ratifying and completing the tests

as a joint project which requires finely coordinated temporal and spatial conversational alignment and embodied collaboration between the interacting parties in medially conveyed, fragmented interaction spaces (*fractured ecologies*, according to Luff et al., 2003). This activity consists of recursive directive-response sequences to initiate and perform the individual tests.
While the anamnesis takes place almost exclusively as an activity between the TM and P, the LD, who is often aloof but visibly on “standby” during the anamnesis, comes into play, i.e. with the initiation of the neurological examination, the participation structure changes.

In the medially conveyed neurological examination, a division of labour between the TM and the LD is established when the test is carried out. While the TM is responsible for the selection and diagnostic evaluation of the tests, the LD participates in some tests as an "extended arm" for the test execution. For this purpose, the updating of practical medical knowledge on the part of the LD as well as its verbal, bodily and instrumental implementation is necessary. At each single step of the examination, the P must also understand what actions he/she has to perform to complement the activities of the LD. Each test requires a specific participation structure, which must be newly established (LD: shine into the eyes, P: keep your eyes open; LD: make movements in front of the field of vision, P: follow with your gaze, etc.) and maintained or modified during test conduction.

The termination of the test performance via ratification requires the negotiation of corresponding responsibilities, constructed along the possibilities and limitations of professional perception under the circumstances of video mediatization. While examining the line of sight, the

affordances of media technology allow for close viewing so that the TM can evaluate the performance. Tests that require a tactile assessment (e.g.when checking the muscle strength of the hands), on the other hand, have a diagnostic limitation for the TM: multi-sensoriality (e.g. Mondada 2019) is only possible between the LD and P. Thus, sensory impressions (apart from visual) gained by the LD are announced to the TM while being translated into medical categories.
The logical requirements of initiating and possibly modulating other people's actions – the TM must instruct actions by the LD and/or P, and patient actions must be initiated and, if necessary, modified – are reflected in a corresponding conversational dynamic of the testing: Complex multimodal and multimedial directive-response sequences turn out to be the "heart" of this activity.

5 Results

In the following, we will show the practices of how participation is negotiated, how (instrumental and embodied) action is projected and how evaluations of sensory-motor test performance are made available while initiating, performing and completing the tests. The following excerpts will show that the interlocutors ascribe and negotiate medical knowledge *en passant* while preparing and conducting the test. Also, the participation of the patients in this joint project should not be neglected, since their preparatory actions show a high level of cooperative anticipation of the prerequisites and requirements for action as well as of the goals of the tests.

5.1 Initiate the examination in a coordinated manner: Establish participation frameworks, instruct actions with epistemic sensitivity, and create bodily-instrumental prerequisites

One of the tasks that the TM sets at the beginning of each test is to call up the upcoming examination and, if necessary, to convey the necessary knowledge for performing the test. In doing so, the required forms of participation (here in particular: the extent to which the LD is involved) and collaboration (which task is assigned to the interlocutors) must be clarified. The LD and P are asked to understand the respective preparatory actions and noticeably implement them. Since the TM is the one who has to assess the examination from a computer screen, corresponding visibility management is required, which makes it possible to follow the demonstrations of the physical

reactions in a valid manner. On the one hand, this concerns using media-technical equipment (camera settings, e.g. zooming in), especially for eye examinations, to create good conditions for visual perceptibility. On the other hand, the LD's test execution must be oriented towards the camera so that the TM can observe it on the screen.
Excerpt 1 shows how the TM prepares the test execution and creates the necessary knowledge and prerequisites for action.

Excerpt **1: Creating conditions for the examination**[4]

01 TM: hm_hm, (-)
02 okay
03 <<f>gut-> =
good

04 dann würd ich sie gErn mal noch unterSUchen?
then i'd like to examine you again

05 (3.00) ((mouse clicking for camera zoom))

#1

07 dann blEiben_se a:ls Erstes (-) einfach mal #1SITzen?=
then just first remain on your sit

08 =dann (.) fangen_wa mal mit den AUgen an?
then let's start with the eyes

09 (---)
10 TM: ich komm grad mit der kAmera mal NÄher,
I'll come closer with the camera

11 (3.8) ((camera zoom))

[4] For the sake of better visibility, the still images in transcripts are cut in such a way that one can better recognize the TM and the situation in the hospital. The left image represents the TM, the right image the LD and /or P.

12 TM: stell mir ihre AUgen mal ein?
adjust your eyes for me

13 (3.0)

#2

14 TM: frau[#2] lIebler würden sie bitte nochmal die: (.) des eh:m die BLICKfolge testen,
Ms. LIebler would you please do the eye tracking test again

The excerpt begins with the TM ending the anamnesis with multiple discourse markers (Z. 01-03). This is followed by the announcement of the neurological examination, in which the TM is positioned as an actor in the following test phase due to the choice of the personal pronoun 1st pers. Sg.: *then I would like to examine you again?* (line 04). The request to remain seated (line 07) then specifies the part of the patient's action required for the first examination. In the following announcement, she informs the TM and the P about the first focus of the examination: *= then (.) let's start with the eyes?* (line 08). It is not initially clear whether "*we*" here is an inclusive pronoun (TM, LD and P) or whether the TM is opening a dyadic project of action.

Through *online commentaries* (e.g. Heritage/Stivers 1999, from now on OC) (lines 10, 12), the TM documents her media-instrumental actions of zooming in with the camera, starting in line 08, which serves as preparation for the investigation. This is made available for the LD and the P, although they cannot observe directly the modalities of doing (how it zooms) and the consequences (how close does the P's face appears on the screen; see stills #1 and #2).

Heritage/Stivers define OC for face-to-face discussions in medical practice as "the talk that describes what the physician is seeing, feeling or hearing during physical examination of the patient" (Heritage/Stivers 1999: 1501).

Another function of OC is shown here: the TM use them during the preparation of the examination and documents with them what they are *doing*. In doing so, TM take into account that their media-technical actions, as well as their effects (the enlarged camera image and better view), are not accessible to the other parties involved in the course of the process. In addition, OC make transparent for the P what is in the focus of the examination by the doctors so that the former can adapt their bodily behaviour (namely: look into the camera if possible, open their eyes, etc.). Another function of the OC is to bridge the verbal pauses resulting from creating the examination's technical prerequisites. That also shows that TM is assigned the right to conversational initiatives. The metaphorical expressions "I'll come closer" and "I'll adjust your eyes for me" are interesting insofar as they suggest the – at least partial – overcoming of the spatial and media-induced bodily intermediacy between the therapist and patient and, at least from the therapist's perspective, visually narrow the participation framework to the dyad of therapist and patient.

In line 14, the TM then issues a request to the LD. The initial onymic addressing (Günthner 2016) defines the LD as the addressee and actor in the required action. Since the computer-mediated interaction offers no direct eye contact and no possibility of turning towards the LD or the P, the addressee of instructions must be disambiguated. Particularly in the present sequential context of medical requests and instructions that require prompt execution, it is of essential importance for the successful implementation of the response (i.e., the execution of the required action) to disambiguate the addressee. The onymic addressing not only contextualises the interactive problem of double addressing and addressability in the triadic participant constellation; its use may also indicate that the LD appears less accessible due to the camera setting focused on P and must be "called into" the conversation again as a bystander. As a deontic marker, the onymic addressing further projects a directive to follow.[5]

The participation framework for carrying out the following neurological test is also established by the use of a practice that we call *knowledge-*

[5] In the conversations studied, there is also evidence of requests in which onymic or nominal forms of address ("Herr Kollege") are used in an utterance-final manner, sometimes after a pause. In these cases, the deontic character of the addresses is emphasised even more.

presupposing requests.[6] These requests contain technical terminology (*gaze sequence*, *field of vision*) and are only minimally explicit (for the patient) as they only specify the purpose of the investigation. The single steps that are specifically necessary for the implementation of the test remain just as implicit as the actions of the P. They require knowledge on the part of the LD about the technical terminology used as well as about the goal and the execution of the test. The LD is thus ascribed expert knowledge, which they comply with by adequately executing the test. The attribution of professional medical knowledge to the colleagues on site is also an epistemically sensitive, face-saving practice that refers to the co-expertise of LD and TM. In that the LD is the addressee of such requests, they constitute a form of intra-professional speaking. Since these *knowledge-presupposing requests* are successfully decoded in many cases and translated into an adequate test implementation, this request practice also proves to be the most economical form of ”getting things done” (Ehmer, Helmer, Oloff, Reineke 2021) for neurological testing.

The fact that the P also uses hints in the request to align his bodily action to a smooth implementation is shown by a minimal facial reaction of the P: He narrows his eyes on the word “look”, which signals his understanding in the form of a minimal bodily reaction and cooperation for the following investigation (patient’s eyes not shown due to ethical considerations).

In excerpt 2, the interlocutors use the emerging syntactic structure and the thematic roles of the predicate to establish the framework for participation. As soon as the grammatical object is produced, not only the addressee is disambiguated but also who is going to take the active lead during the upcoming test.

[6] “Knowledge presupposing request” is a translation from German "epistemisch voraussetzungsvolle Aufforderung". These are requests that require a certain knowledge to comply, and by uttering them they ascribe it to the addressee.

Excerpt 2: Grammatical object as address-marker

#3 #4

01 TM: vielleicht könnten sie[#3] DAzu einmal der patientin-[#4]
perhaps you could shine into the patient's

02 TM in die AUgen reinleuchten-
eyes

The physical reaction of the P shows that she uses TMs request addressed to the LD to decode her role as a recipient: She looks up to the LD immediately after having heard "the patient's" (the dative object, #4). This example also clarifies that Ps not only create the necessary physical prerequisites for the upcoming examination when prompted but that they, as recipients, derive indications for their form of participation in the upcoming test from the talk between the LD and TM. In the conversations examined, it is regularly proven that the P performs bodily (e.g., head posture, gaze, even blinking) or instrumental (putting on glasses, putting away handbag) actions at this point, which show their understanding of the corresponding examination requirements and goals, and signal a willingness to cooperate (=participate in the conversation) and collaborate (=contribute to the success of the examination). In doing so, they actively shape the framework of participation: In anticipating their upcoming role in the test, they quit their role as a "patient" overhearer of intra-professional talking and, at least on a physical level, display a more active form of collaboration at this point. The multimodal conversation-analytical approach to fine-tuning the medical and patient-side conversational action can thus reveal that the execution of the

test does not only begin with the addressee-specific verbal instruction of the LD to P but that the P already presents himself beforehand as a "thinking object to be examined", who derives his action partly from the request to the LD and creates the corresponding physical conditions. Conversations in which the P has to correct such anticipatory actions – self- or other initiated – show that this point of the examination process is a sensitive one, as happens several times in excerpt 3:

Excerpt 3: Self-correcting anticipatory actions

#5

01 TM: würden sie bitte noch einmal das geSICHTSfeld überprÜfen, [#5]
would you please check the field of vision again

02 (0.7)

#6 #7

03 LD: JA-[#6]
yes

04 (--[#7]--)

#8 #9

05 LD: (passen sie bitte auf) o_ob[#8] sie meine HÄNde sehn;[#9]
(please take note) whether you see my hands


#10

06 WANN[#10] sie sie sEhen;=ja?
when you see them yes

07 LD: welche [SEIte sich bewegt;
which side is moving

08 P03: [hm_hm,

09 (3.3)

At the beginning of the excerpt, the TM asks the LD to identify the patient's field of vision, i.e., check their peripheral vision. Immediately after the last word of the request, the patient moves both hands up to chin level and holds them there for a moment in a "trembling" motion (still #5). With the understanding documentation of the LD (line 03, still #6), the P moves her hands further up to the sides of her glasses to lower them again (without the glasses) (still #7). While the LD is instructing her (line 05), the P then takes off her glasses briefly (still 7) and puts them back on – notably simultaneously with the perception verb *see* (line 5, still #9) – to do the test. The LD prepares this by moving behind P's bed (still #10). That makes it clear that preparing for the test also means creating visibility for the TM.[7]

Overall, the example shows how the instrumental actions of the P signal the online disambiguation of the prerequisites necessary for carrying out the test. While the patient is gradually deriving the necessary information from the instruction of the LD, the alternating raising and lowering of the arms or touching the glasses after the request of the TM indicates an interpretation problem: She cannot deduce from it whether it is relevant that their eyes are accessible for the LD and TM (glasses off) or whether it is about a visual

[7] A teaching video for medical students at the University of Mainz demonstrates how the visual field test is carried out in a dyadic face-to-face constellation; here the doctor sits in front of the patient (Angelika Gutenberg, https://www.youtube.com/watch?v=-1HWupXahKI, accessed on September 27, 2023).

performance on her part (glasses on). In another conversation (see excerpt 4), this is what is explained in preparation for the pupil test:

Excerpt 4: Explaining test intention and clarifying necessary patient action

01 TM: °h jetzt würde ich grade mal die kamera SO einstellen-
now I would just set the camera in such a way

02 dass man ihre AUgen ganz genau sehen kann-
that one can see your eyes very clearly-

03 sie bitten die brIlle kurz ABzunehmen?
can you please take off your glasses for a moment

04 für die ERSte untersuchung,
for the first examination

The TM here not only comments on her instrumental actions, as we have already seen in excerpt 1, but also explicitly explains in a final sentence their immediate purpose: the improvement of her own visual perception. Her request in lines 03 and 04 also clarifies not only the necessary action required from the patient's side but also its relevance to the subsequent examination of the pupils.

5.2 Conduct the examination collaboratively: Instruct and correct others actions, make one's own actions visible

The collaborative action of the LD and the P as a mandatory part of the response to the TM's request is the conversational core of performing some of the neurological tests. As a rule, this requires preparation on the part of LD: The purpose of the examination (testing the line of sight, checking the field of vision, etc.) as specified in the TM's request must be translated into target-oriented action steps that are coordinated between the LD and P. For the LD, this means that they have to update their medical knowledge and implement it in embodied and instrumental actions to carry out the examination. Further, it is necessary to adjust the implementation of the test to the triadic face-to-screen constellation and ensure visual accessibility for the TM. In most consultations, this task is handled *en passant* and appears to be unproblematic, insofar as the test performance is usually directed towards the camera. Cases like the following, in which the test execution must be corrected, show that making one's medical activities visually available for a third party can be a challenge for the LD.

Excerpt 5: Establishing visibility

14 TM: frau liebler würden sie bitte nochmal die: (.) des eh:m die
BLICKfolge testen?
Ms. Liebler would you please do the ehm: the eye tracking test again

15 (4.9) ((mouse clicking for camera zoom))

#11

16 LD: sie müssen blOß auf die (-) #11SPIt[ze] schauen;
you only have to look at the (-) tip

17 TM: [<<p>hm_hm,>]

18 LD: und dann (mit_n [AUgen folgen)
and then (follow with_your eyes)

19 TM: [könnten sie bIsschen zur SEIte gerad treten?=
could you step a little to the side

#12

20 =dass ich die #12AUgen SEHen kann?
that I can see the eyes

Excerpt 5 follows excerpt 1 discussed above. It was reported that the examination modalities (it is about the eyes) were conveyed in the preparation of the gaze following test using OC and that visibility for the TM would be relevant in the following. Nevertheless, a problem arises in the following response: The TM initiates the test with a *knowledge-presupposing request* to the LD (line 14) and zooms in on the P's face from the beginning of the request and during the following rather long verbal pause of almost five seconds (lines 14-15). While the LD is now issuing an

instruction to the P, she moves in front of the P with a pen raised in front of the P's face and begins to move the pen from one side to the other (still #3). However, this optimal physical alignment of the LD to the P, typical for a face-to-face situation, obstructs the TM's view of the P's eyes, which the TM had previously set (see excerpt 1, line 12). Correspondingly, the TM interrupts the test instruction and the beginning of its implementation (lines 18 and 19) by initiating a correction of the physical alignment of the LD, which she promptly complies with (still #12). The increment in line 20 accounts for the correction by explaining the TM's intention to see the test performance with her own eyes. By initiating this correction, the TM modifies the modalities of medical action and changes the participation structure defined by the LD to the extent that she defines herself as the primary addressee of the test performance.

In addition to what has been said so far about the special features of performing, documenting, and making medical action available in neurological examinations, the examples shown so far illustrate that to carry out individual neurological tests, it is necessary to explain the action part of the P with appropriate instructions to make it understandable. In tests where the LD is used as an extended arm of the TM for implementation, this interactive task can be assigned to the LD. In contrast to the *knowledge presupposing request* of the TM to the LD, the (partial) actions that the P are supposed to carry out are specified in the instructions. On the other hand, the main purpose of the respective test is usually not explained for the P.

In excerpt 3 above, which is being referred to again here, the instructions from the LD to the P appear on a verbal level in lines 05 to 07. Formally, they are designed – in contrast to the requests to the TM – as imperatives. In other conversations, infinitive constructions (e.g. *looking straight ahead*) or V2 constructions with the deontic modal verb "*must"* are also used (see excerpt 5, line 16). LD touches the patient's upper arm, as can be seen in stills #8 to #10, calling for P's recipiency. Together with the verbum cogitandum "to pay attention" in the matrix sentence of the request, the required focus of attention on the visual is defined and concretised in several successive subordinate clauses by breaking it down in small steps into a WHAT (the hands of the LD), then the WHEN and the WHERE. The corresponding subtask of P, that she should not only accomplish the required visual perception but also verbalize it accordingly as soon as a hand

appears on the right or left in the periphery of the field of vision, is only implied by the instruction.

In excerpt 6, which is directly linked to excerpt 3, a problem of understanding arises, which among other things, follows from the segmented instruction:

Excerpt 6: Correcting patient's actions

#13

10 P03: #13((nickt)) JA:,
((nods)) yes

11 SEH ich;
I see it

12 (0.4)

13 LD: oKAY,

(0.4)

15 welche SEIte,
which side

16 P03 (--) <<pp>rechts;>
right

17 LD: welche SEIte,
which SIDE

18 P03: ä:h RECHTS,
right

19 LD: hm_hm,

The verbal responses of the P in lines 10 and 11 appear immediately in response to the hand moving towards the visual centre with which the LD performs grasping movements. However, they only start after an earlier nod and a small, sweeping movement with the right hand (still #13). The exact

point at which the LD's hand appears in the field of vision is visible to the TM but not to the LD. Failure to name the stimulus side still leads to a doctor's initiation of correction (line 15), at which point the P articulates the word *right*, not audibly but visibly for the TM (as well as for the analyst) (line 16). Following the renewed initiation of the correction, the P repeats (after a hesitation marker), now clearly audible, the correct side (line 18), which the LD ratifies.

This small repair sequence in the test execution, which the LD and P have to cope with here, reveals, on the one hand, that the P only understands after the initiation of the repair that she should name the side where she perceives the stimulus. On the other hand, the P has the task of correctly decoding the action parts assigned to them, which the P only understood in excerpt 6 - possibly due to the fragmented instructions and the lack of clarification about the purpose of the examination – after a "stagnation" in the progress of the joint action.

Secondly, the minimal gestural and articulation-mimic feedback from the patient in excerpt 6 shows an (additional) addressee orientation towards the TM, which fits in with the fact that the LD also makes the test performance visible for the TM. The interactive task for P, therefore, is to derive from the instructions of TM and VM and the physical actions of VM, for whom she should primarily make her visual perception inter-subjectively available. In contrast, this interpretation is unproblematic in excerpts 1 and 3 shown above, in which medical OC have it clear that the test performance should be visible for the TM. Even if this is no guarantee that the test will be carried out without problems (see excerpt 5), in our opinion, it can be considered as best practice to clarify the primary addressee (= perceivers and assessors) of the performance before each examination.

5.3 Completing the examination: Making perceptions inter-subjectively available & evaluating test performance intra-professionally

To complete the examinations, the interlocutors must agree to cease the bodily-instrumental actions required to carry out the neurological tests. Recurrent ratifications after the implementation reflect that the TM sees it as their interactive task to recognize the required test performance as sufficient or even to evaluate it in the direction of diagnostic findings. In the following

excerpt, we see the commonly observed case where the timing of the completion is determined by TM.

Excerpt 7: Terminating test performance

01 TM: einmal bitte die ZUnge rausstrecken?
please ((Part.)) stick out your tongue

02 (1.34)
03 und nach RECHTS und LINKS bewegen die zunge?
and move your tongue to the right and left

04 (1.48)
05 JA;
yes
06 SUper-
super

The point of termination is closely linked to the TM's perception of the horizontal tongue movement, which is documented through minimal positive ratifications (lines 05 and 06) indicating that the test performance was sufficient. The evaluation *SUper-* (line 06) also provides P and VM with clues regarding the diagnostic assessment, namely that the performance is to be classified as inconspicuous.
Pre-diagnostic commentaries, which – in contrast to dyadic situations – are addressed primarily to the LD in the present triadic constellation, are also documented as the termination signal of the examination sequences. See the following excerpt:

Excerpt 8: Visual impressions of the LD and TM

258 TM: die schauen soweit ganz (-) isoKOR aus,=
they look quite isochore

259 =die kamera licht reaktion haben Sie wahrscheinlich besser gesehen als ICH;
you probably saw the camera light reaction better than me

260 (0.87)

The pre-diagnostic commentary by TM in line 258 is not only used to end the test performance. In contrast to the minimal ratifications in excerpt 7, it further reflects an uncertain state of knowledge concerning one's diagnostic conclusions, resulting from the limited visibility of the pupillary reaction. In

this way, the TM presents their visual perception as something that needs to be intersubjectified and negotiated intra-professionally towards a corresponding diagnosis. By assigning better perception in line 259, the LD is positioned as the person responsible for validating his visual impression after he had "only" assisted in the previous implementation phase of the light reaction test. The factor of direct access to diagnostically relevant knowledge through the perceptibility of test performance proves to be constitutive for the design of test completion, as it necessitates different forms of division of labor between VM and TM after the test procedure - specifically, for intra-professional perception, perception documentation, and evaluation.

Especially when examining muscle strength, the sensory accessibility of the TM is characterized by restrictions due to the mediatization: The TM cannot derive directly, but only visually from the camera image, how strong the arms of the P are when stretching or bending. Consequently, they are not only dependent on the assistance of the VM as an "extended arm" in carrying out the corresponding examination procedures; in the final phase of this test, the VM also has the task of perceiving tactically on behalf of the TM. Excerpt 9 shows how the LD, but also the P make their perceptions intersubjectively available and thus provide the TM with indications for a diagnostic assessment:

Excerpt 9: Gaining intersubjectivity by tactile perception

06 TM: und fra:u LIEBler sie versuchen,
and Ms. Liebler you try to

07 (--)

08 TM: [di:e ähm Arme (-) ABstrecken;
stick out (-) your arms

09 LD: [JA;
yes

10 TM: sozuSAgen.
so to say

11 geNAU.(--)
exaCTLY

12 FESte,

firmly

13 (1.2)

#14

14 P11: ((P squints his eyes and groans))#14

#15

15 LD: also die linke#15 (.) HAND gibt nAch;
so the left hand gives way

16 (---)

17 TM: hm_HM?

18 weil das SCHMERzen macht,
because it hurts

19 Herr Elfer?
Mr. ELfer

20 P11: ja.
yes.

At the beginning of the example, the somewhat complex implementation of the test is instructed (lines 06-10), ratified (line 11) and modulated online (line 12). It stipulates that the P bends his arms and should hold them against the force of the LD, which happens for one second (line 13). In the completion of the test procedure, a finely coordinated timing between the physical, paraverbal, and verbal actions of VM and P is visible: the patient

gives in with his arms and squints his eyes. The subsequent groaning (line 14) also signals physical discomfort (cf. Heath 2002) and provides an account for the marked situation that the execution is terminated by him and not by the LD or TM. Partly overlapping with the groaning, the LD documents her tactile perception with an OC by describing the reaction of the left hand to the counterforce exerted (line 15). To convey her impression to the TM, she turns to the camera (still #15), after having positioned herself with her back to the camera during the procedure, treating the examination as a dyadic project in this way. The TM documents her understanding of the physical reaction (the abrupt loosening of the arm) as caused by pain by asking the patient to confirm (line 20).

Excerpt 9 shows that the LD has the task of professional perception and intersubjectification of this perception if this is not fully accessible to the TM. In the case of tactilely perceptible test performances, this task is taken over "automatically", without this having to be negotiated beforehand; while the TM has to inquire about the visual impression of the LD in excerpt 8, the LD forwards her observations in excerpt 9 to the TM on her initiative. For his part, the P uses facial and vocal resources to make his pain perception available.

Overall, it becomes clear that the interlocutors fine-tune the timing of the end of the test performance and shape it, taking into account their own medially conveyed perception and the ascribed other's perception. During the termination phase, the more or less fragmented sensory accessibility to the respective other interaction space is reflected in complex ratification processes. The least laborious case is that the TM initiates the termination with full sensory access to the test performance, often with minimal final signals (e.g. *hm_hm*, *okay*, *good*). Positive evaluations (*super*) give the other two interlocutors additional information about the diagnostic valence. Limited visual perception on the part of the TM requires either corrections in the test performance (see excerpt 5), a (more or less direct) demand for the assessment of the LD and negotiations to intersubjectify the mutual “professional view”. When the LD has the task of vicarious tactile perception, as we saw in excerpt 9, they verbalize the sensory impressions for the TM.

6 Summary and Conclusion

The present article aimed to outline the interactive tasks involved in collaborative neurological examinations within a triadic participant constellation in the medical context of teleconsultations for stroke diagnostics. Furthermore, it sought to identify and analyze the multimodal and medial practices which the interlocutors deploy in the initiation, implementation, and completion of neurological examinations.

The analysis has shown that the division of labour between the LD and TM does not imply that the former merely acts as an "extended arm" of the TM, but rather as a "knowing executive arm". The participation structure and forms of collaboration can change rapidly depending on the required test modalities and throughout the phases of initiation, implementation, and termination.

The initiation of the individual tests has proven to be a relevant task in which the TM must establish the required participation structure (who takes part in the test actively, who is a bystander). Alongside onymic forms of addressing the LD, typically there are *knowledge presupposing requests* of the TM to the LD, in which implementation modalities of the respective examination steps are implied. The P cooperate early on a physical level by anticipating the goals and implementation prerequisites to create the examinations' physical conditions.

However, the necessary forms of collaboration are not always clarified in the conversations we examined during the initiation of the tests, and in the case of a test implementation coordinated between VM and P, this task often falls to the former. Anticipatory cooperative actions on the part of the P turn out to be dysfunctional for the execution of the test in some cases due to the lack of knowledge about the implementation and purpose of the examination. From an applied CA perspective, the best practice would be to enable adequate patient cooperation at this sensitive point through explanations.

The analysis has also shown that the TM uses online commentaries to document their actions, which are more or less accessible to the other interacting parties, both in the preparation and the implementation of the individual tests, primarily zooming in on relevant parts of the patient's body with the camera. The TM thus contribute to making professional activity

transparent. The fact that verbal pauses are also filled through such comments reveals their overarching right to conversational initiatives, reflecting also a local gap in professional responsibilities in the consultation.

To conduct the tests, the LDs must decode *knowledge-presupposing requests,* instruct P and coordinate the interaction between their own and the patient's instrumental-bodily actions. Additionally, there is the interactive task of visually making the test performance available to the TM. The conversations show that LDs usually instruct P's actions in small steps. The dual interactive task for P, to quickly understand the action requirements and also to disambiguate who the primary recipient of the test performance is, proves to be an interactive stumbling block in some conversations, leading to brief delays and repairs in the test execution. For the termination of the individual neurological tests, it has been shown that the patient's actions are completed by documenting the medical perception of the test performance via ratification. If the P and LD are engaged in the execution, it is terminated by the TM or LD. The termination with the P is treated differently (cf. excerpt 9). In visual impressions, the speciality is that the "professional looks" of the TM and LD have to be intersubjectivized and brought into harmony. Here and in an extreme form with tactile assessments, the media-related restrictions on accessibility to the patient's body are particularly evident.
Following on from a desideratum formulated by Beul (2013) to name the necessary communication skills of telemedicine practitioners, a suggestion would be to "straighten out" the interactive tasks required in parallel for the P by a) clarifying the orientation of the testing (for the LD or TM), and b) conveying more knowledge about the purpose of the test in the announcements or instructions. Further studies are both possible and necessary here.

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Transcription conventions (Selting et al. 2009)[8]

[word wo]rd [words]	overlap and extension of simultaneous talk
°h/h°	audible in-/outbreath
(.)	micro pause, estimated, up to appr. 0.2 sec duration
(-)	short estimated pause, up to appr. 0.2-0.5 sec duration
(--)	intermediate estimated pause of appr. 0.5-0.8 sec duration
(---)	a longer estimated pause of approximately 0.8-1.0 sec. duration
(0.4)	measured pause of 0.4 sec duration
and_uh	cliticizations within units
eh, uhm	hesitation markers, so-called "filled pauses
((coughs))	non-verbal vocal actions and events
<<coughing> > until >	non-verbal vocal actions with indication of scope
(such a)	assumed wording (in an almost unintelligible passage)
=	latching of intonation phrases
:	lengthening
?	cut off with glottal closure
SYLlable	focus accent
sYllable	secondary accent
?	rising to high

8 For the complete set of transcription conventions refer to http://www.gespraechsforschung-online.de/fileadmin/dateien/heft2011/px-gat2-englisch.pdf

,	rising to mid
–	level intonation
;	falling to mid
.	falling to low
<<f> >	loud, scope until >
<<p> >	low, scope until >