"I can't get round": Recruiting Assistance in Mobile Robotic Telepresence

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Via audiovisual communications and a controllable physical embodiment, Mobile Robotic telePresence (MRP) systems aim to support enhanced collaboration between remote and local members of a given setting. But MRP systems also put the remote user in positions where they frequently rely on the help of local partners. Getting or 'recruiting' such help can be done with various verbal and embodied actions ranging in explicitness. In this paper, we look at how such recruitment occurs in video data drawn from an experiment where pairs of participants (one local, one remote) performed a timed searching task. We find a prevalence of implicit recruitment methods and outline obstacles to effective recruitment that emerge due to communicative asymmetries that are built into MRP design. In a future where remote work becomes widespread, assistance through remote work technology like MRPs needs close examination at a fundamental interactional level, taking into account how communicative asymmetries are at play in everyday use of such technologies.

CCS Concepts: • **Human-centered computing** → **Human computer interaction (HCI)**; **Empirical studies in HCI**; **Collaborative interaction**; **Empirical studies in collaborative and social computing**.

Additional Key Words and Phrases: mobile robotic telepresence; remote work; remote help; videoconferencing; computer-mediated communication; asymmetry; ethnomethodology; conversation analysis

1 INTRODUCTION

The COVID-19 pandemic has highlighted the need for a range of flexible and robust remote collaboration technologies. While traditional 2D video meetings will undoubtedly make up the bulk of remote collaborations for some time to come, Mobile Robotic telePresence (MRP) systems may become less exotic as organisations seek ways to enable more flexible physical workplace presence due to social distancing requirements. MRPs generally consist of a video conferencing system mounted on a remotely-controlled mobile base. The pilot user drives the robot from a computer or smartphone interface and interacts with people physically co-present with the MRP. As such, the pilot user has a degree of physical autonomy and embodiment that is not present in traditional videoconferencing systems, but phenomenologically different than being co-present. MRPs also have a number of limitations. Slow, wheeled, bulky, and dependent on a solid network connection, they can be hard to navigate at the best of times, let alone also hold a conversation. They lack audio feedback, making it hard to gauge how loud the pilot user's voice is being projected [20], and offer limited resources to sense people and things outside their field of view. Taken together,

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these features often leave pilot users needing help from local people—but asking for help is not a neutral act. Given these issues, what do we need to know about recruiting assistance, from its practical methods to its micropolitics, to enable an effective and inclusive workplace?

Recruiting assistance is foundational to a vast array of everyday social interactions, and not always overt. For example, when getting up from the table to retrieve an object elsewhere, co-present others might pull their chairs closer to the table to clear the path [18]. Research on the production of requests has looked at how assistance is solicited in face-to-face and telephone interaction, often looking at the speakers' directness as it is enmeshed in situational factors and how expectations shape the interaction [2, 7, 12, 17]. More recently, conversation analytic work from Kendrick and Drew [18] examined how people recruit others to assist them in their courses of action using a variety of linguistic and embodied actions. Kendrick and Drew argue that we can think about methods of recruitment in terms of a set of categories placed across a continuum ranging from explicit to implicit [18]. For example, a request "Can you move the chair?" is more explicit a recruitment than a report that "I can't move around because of the chair", and a person chooses one or the other based on a range of circumstances. Given the obvious need for frequent help associated with MRPs, this research on the organisation of social interaction, can shed light the needs of MRP design and workplace guidance.

CSCW has of course explored some aspects of assistance before, as it plays out in and through the use of digital technologies (for e.g. [19]). But these accounts still tend to leave out the practical interactional details of how it is solicited and geared into ongoing social interaction. To our knowledge no study has explicitly looked at the work and strategies of recruiting assistance in computer mediated communication. However, significant work has been done on communicative asymmetries in video-conferencing ([11, 28]), and in our study we see the imbalance in physical abilities and access to information between the local and remote participants as clearly shaping their interactions and thus impacting on effective recruitment of assistance.

In this paper we bring work from Conversation Analysis on recruitment of assistance to address CSCW's concerns with video technologies for remote collaboration. We draw our insights from an experiment in which pairs of local and remote participants are engaged in a collaborative searching task, where the design of the experiment surfaces methods of recruitment and assistance. Drawing from literature on face-to-face assistance and CSCW work on communicative asymmetries, we examine the structure of the interactions and how it is shaped by the asymmetries introduced by the medium of MRP. Our breakdown of how certain types of asymmetries influence and obstruct the recruitment of assistance may be useful to inform future design of telepresence and user guidelines in order to reduce the asymmetries and enable collaborators to engage in assistance more effectively. Doing so may empower remote users to participate in activities with their local co-workers on a more equal and capable footing.

2 RELATED WORK

First we unpack further details on research exploring moments of requesting and assistance recruitment. As part of this we outline Kendrick and Drew's explicitness continuum on which recruitment actions can be placed. We also present the concept of pre-beginning actions in recruitment and discuss assistance motivated by responsibility and commitment to a common goal. We then review CSCW literature on communicative asymmetries and on compensation work to overcome those asymmetries.

2.1 Assistance recruitment

Our jumping-off point for this study is that asking for help is not neutral. This position is drawn from Brown and Levinson's politeness theory, itself based on Goffman's concept of 'face' [2, 9].

Central to this view are the ideas of 'negative face' (a claim to freedom of action and freedom from imposition), and 'positive face' (a likeable self-image, which everyone is motivated to preserve for themselves and others). Requests, in this model, potentially threaten the addressee's negative face, by imposing on them an obligation, and potentially threaten the speaker's positive face by appearing inconsiderate. To minimise face-threat, people may employ different strategies of indirectness to reduce the imposition or provide redress to justify it. Subsequent literature on requests has looked at what strategies and level of directness are used when requests are accomplished, and suggested that those depend on the specific organisational situations. For example, Heinemann's study on elderly care recipients and Curl and Drew's study on phone calls to friends and doctors, showed more mitigating devices and prefacing when speakers felt less entitled to make the request [7, 12]. To make requests, then, a variety of strategies are available and a person chooses to employ will be a product of their circumstances and expectations. However we also stress the primacy of the *interactional production* of such phenomena such that e.g. an utterance can be heard and treated as an 'imposition' as part of unfolding social organisation, rather than some 'impositional property' being intrinsic to that utterance.

We base our analysis on Kendrick and Drew's comprehensive, empirically-based conceptualisation of assistance recruitment [18]. Kendrick and Drew examine the linguistic and embodied actions people used in face-to-face interactions which signaled trouble and led to the provision of assistance to resolve that trouble. They then present those as categories on a continuum, ranging from most explicit to most implicit. On the most explicit side are requests, where the Self verbally expresses what kind of assistance they need from the Other and directly asks them to provide it ("Could you give me X?"). Notably, the Self here does not have to describe the nature of their trouble, just what they need in order to resolve it. Next are reports of trouble, where the Self states what kind of trouble they are facing but does not specify a solution nor obliges the Other to provide one ("I can't do X"). Then there are trouble alerts, in which the Self expresses that they are having trouble but does not communicate what the trouble is. These mostly consist of cries, interjections and imprecations. After that, are embodied displays of trouble, where the body movements of the Self indicate to the Other that they are having trouble. For example, the act of hovering one's hands over an area might inform the Other that the Self is looking for something. Finally, at the most implicit end of the continuum, they position projectable troubles, which are situations where the Self does not do anything to express a need for assistance but the Other is able to anticipate it from the circumstances. They point out that only requests create an obligation to help and necessarily initiate an adjacency pair in which assistance is a relevant response. All other actions simply create an opportunity for the Other to help.

In addition, noting that recruitment usually does not occur without context, Kendrick and Drew propose the term subsidiary action, to describe linguistic and embodied actions taking place before the recruitment sequence which set it in motion and support the resolution of the trouble. Keisanen and Rauniomaa had previously also looked at such actions, referring to them as pre-beginning actions [17]. Their analysis highlights that requesting is a situated act that varies based on the social and material setting as well as the participation organisation and other ongoing activities which all create contingencies. They show that a pre-beginning action's interpretation is unavoidably tied to the situation in which it occurs. For example, when a driver in a car holds up a coat, her partner immediately understands that she is about to ask him to hold the coat for her, since she cannot maintain that position whilst driving. The situation of the car and the associated activity of driving give meaning to the action of holding up the coat.

Further, in response to Kendrick and Drew, Zinken and and Rossi point out that sequences of assistance recruitment arise within different levels of responsibility and commitment [30]. For instance, a mother picking up a toddler from the father's lap could be motivated by her responsibility

as the primary caregiver rather than as response to the father's need for assistance. Also, interaction partners engaged in a shared task are committed to the same goal, so any assistance they provide could be seen as a contribution towards the completion of the task. As our data is from a task designed to be done collaboratively, and thus had help-giving "designed in", we have focused our analysis on incidents aimed at overcoming trouble relating to limitations of the MRP (mainly trouble navigating to locations) rather than trouble doing the collaborative search task (locating the items).

2.2 Communicative Asymmetry

When examining assistance recruitment through technology such as MRP, the situation may be characterised by 'communicative asymmetries' as a result of the two parties approaching the task from different media. Heath and Luff argued that video-mediated communication has asymmetries, which do not exist in face-to-face interactions nor in other media such as phone calls, and which influence the users' visual and vocal conduct [11]. In face-to-face interaction, there is symmetry as both parties have access to the same visual information and accurate knowledge of each other's perspective. In telephone calls, while there is no access to visual information there is also no assumption of it being relevant to the communication. As Heath and Luff demonstrate, however, in video-mediated communication people use visual information such as embodied cues in ways seemingly relevant to the interaction, but access to it is asymmetrical for each party. They find that visual cues such as gesture and gaze, which people use to coordinate the interaction, are weakened in their effectiveness by the medium. Further, in face-to-face interaction participants know how their actions appear and therefore can adjust them effectively, but participants in video-mediated communication do not. For example, gazing at a co-located person will usually get their attention, but this does not happen in video resulting in the person staring at their intended co-participant without result and without timely feedback of its ineffectiveness. Luff et al. use the term "fractured ecologies" to describe the mismatch in access to the scene in which the action is taking place in their paper exploring the use of gesturing technology over this problem [21]. Voida et al. outlined in more detail different types of asymmetries that can be observed in media spaces [28]. Specifically, they talk about asymmetries of media (referring to the different kind of content shared by individuals), fidelity (amount of detail), participation, engagement, benefit and place (local cultural norms). Saatçi et al. also point out that hybrid video meetings highlight not only technical asymmetries but also socio-cultural asymmetries in language, culture, and digital literacy causing remote participants to feel isolated and less able to participate [24].

It has further been suggested that the disruption that occurs due to asymmetries requires that the users do 'compensation work'. Hindmarsh et al., for example, found that participants in a virtual environment compensated for their fragmented views by verbally expressing their actions and difficulties [14]. Karsenty looked at help dialogues of experts helping novices edit a text in side-by-side, remotely but with shared screen and remotely without screen (audio-only) conditions [16]. While the pairs were able to communicate in all conditions, it was found that the novices adapted their requests to include the necessary information and the experts adapted their interpretive strategies based on the available content.

As we outline in the findings and discussion sections, some of the asymmetries of video-mediated communication are also present in MRP as well as some additional asymmetries relating to the practical capabilities of the robot. These magnify the pilots' need for assistance and unavoidably affect how the recruitment is accomplished.

3 STUDYING MRP USE

Although our paper uses data from an experimental study investigating collaboration between remote MRP and local participants, we take an Ethnomethodological and Conversation Analysis

(EMCA) orientation to the audio-visual data captured as part of the experiment [10]. This EMCA orientation to the experiment and the data it produced entails focusing on the ways in which social order is produced between local and remote participants. It is also critical we understand this production of social organisation emerged in the context of participants taking part in an experiment or technology trial which itself had a particular framing and configuration to the parameters of that participation, all of which is at play in the ways we make sense of how remote and local participants organise their conduct with one another to achieve the task set by the experimenters.

Before we focus further on this approach and its implications we will briefly detail the MRP experiment in terms of broad design, participation, and the experimental procedure. Understanding the details of the experiment is important to make sense of the data that we will show later.

3.1 The MRP experiment design

The data we use in this paper comes from a within-subjects experiment, in which participants performed a task once with an MRP and once with a different prototype, in a randomized order. We only analyse the video data of the pairs in the MRP condition.

Ten pairs of participants took part in the study, recruited from within the regional office of a global technology organisation. Their ages ranged from 25-54 (M = 35, SD = 7.3). Eight of the participants were female and twelve were male. The study took place in the offices of the organisation. As such, some of the participants were familiar with the space of the task, but none had visited it via MRP and the pre-study familiarity did not influence the participants' ability to complete the task. Participant roles (remote or local) were assigned based on the order in which people signed up for the study and roles did not switch between trials. None of the paired-up participants knew each other prior to the study. One of the participants performed the study in person (local) and one using a Beam MRP system (remote). The remote participants were set up on the Beam interface using a computer in another office in the same building, and they had an experimenter by their side throughout the study. As part of the whole study, the pairs performed a searching task followed by a word-guessing game, but in this paper we analyse only the searching task data.

For the searching task, the pairs had three minutes to look for five items each, within a specified area of the office. Timing the task ensured that all participant pairs were given the same amount of time and motivated them to focus on the search rather than other activities. The local participant had to find five ping-pong balls and the remote participant had to find five pieces of pink paper. The two tasks were selected so that both participants would encounter a similar level of difficulty given their capabilities (ping-pong balls were difficult to spot via the MRP, while papers were very easy to see in person). To prove that they had found them, participants had to photograph their items. To do this, the local participant was asked to use a tablet and the remote was asked to take screenshots of their interface with the item in the centre of their view.

An experimenter was present locally in the office with the MRP in which the search task took place. The experimenter was responsible for explaining the rules, capturing data, and keeping time. That experimenter also helped when participants could not resolve problems with the MRP on their own (e.g., when it got stuck between furniture) and when participants asked for clarification of the rules. The experimenter did not intervene in interactions between the participants, and participants only asked questions relating to the the equipment (such as how to take a screenshot).

Figure 1 shows the set up of the experiment as seen from the point of view of the remote participant using the Beam interface. A pink piece of paper is indicated by the red circle and a ping-pong ball by the yellow circle. The local participant can also be seen photographing another ping-pong ball using a tablet.

Participants were allowed to talk and help each other find their items. As incentive, each item found added 30 seconds to the time the pair would be given for a subsequent word-guessing game. When the three minutes were over, the experimenter asked the participants to stop searching and lead them to the area where the word-guessing game would take place.
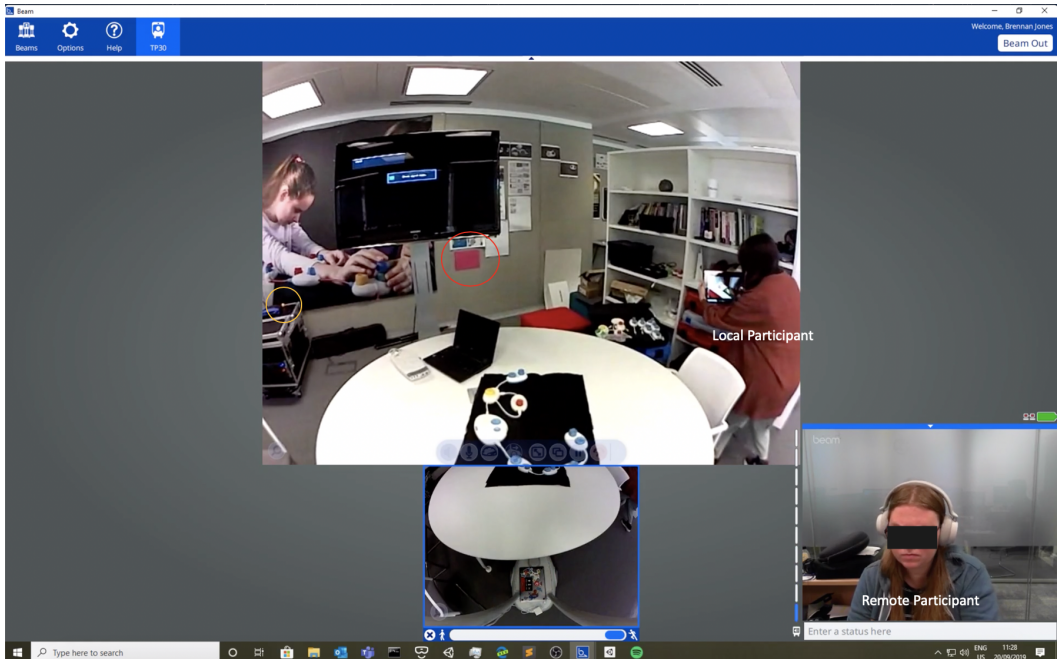

Fig. 1. Experiment set up from the remote participants' point of view showing one of the target pink papers.

3.2 Assistance and recruitment in the MRP experiment's social organisation

One of the prominent features of the experiment's social organisation was the ways in which help and support was both given and requested. That such a phenomenon emerged as a feature was expected given that the whole premise and procedure of the experiment was such that local and remote participants needed to *jointly* accomplish the task assigned to them, thus prefiguring the grounds for mutual help.

In examining this phenomenon, we build specifically on prior conversation analysis work that explores *just how* assistance and recruitment is achieved using both linguistic and embodied methods. In our analysis, we draw on Kendrick and Drew's conception of recruitment and present our findings using the categories they identified [18].

Similar to related work, we take as a given that when working in a shared task, help should be seen as a contribution towards to common goal rather than assistance to the co-worker [30]. As such, we avoided analysing interactions that could be said to relate more to searching task completion (finding the papers' locations) and have focused on interactions targeted at overcoming trouble that hinders the processes necessary for the search (such as navigating the environment and seeing clearly).

4 RECRUITMENT AND ASSISTANCE IN MRP USE

We present a series of fragments drawn from the experiment. Initially we isolated all instances of assistance recruitment from the data and categorised them according to whether the recruitment had been successful or not, and based on the methods proposed by by Kendrick and Drew [18] or assigned a new category where appropriate (e.g., *status reporting*). We selected fragments to showcase the diversity of behaviors we observed and to exhibit the features of recruitment and assistance that routinely emerged in the course of completing the task. Notably, the fragments we present all relate to assistance directed towards the remote participant, as we did not observe any assistance recruitment directed towards the local participant.

To begin with in Fragment 1 (Figure 2) we look at explicit articulations of trouble as it was encountered by participants, along with its resolution via various means. We then explore in Fragment 2 (Figure 3) how anticipations, or projections, of possible troubles were made by participants. Next, in Fragment 3 (Figure 4) and Fragment 4 (Figure 5) we look at two types of moments where there is a failure by a participant to recruit the other to help—often exacerbated by asymmetries in participant perspectives. Finally we examine practices of 'status reporting' in Fragment 5 (Figure 6) where an MRP participant reports troubles but without any apparent expectation of reciprocal help from the local participant. Names appearing in the fragments have been changed to preserve the participants' anonymity.

### 4.1 Reporting troubles and projecting troubles

In this section we look at two fragments that represent the most common methods of recruitment by MRP participants, and also the most successful in their occasioning of subsequent assistance from a local participant.

Fragment 1 is transcribed in Figure 2 below. Here we look at a typical occurrence (three times in our data) of the remote MRP participant reporting trouble as a method of recruiting assistance from the local participant. In the following transcript, the remote participant (R5) and the local (L5) are pausing to check if they have captured all the pink squares or not. L5 spots one that R5 has not captured, and R5 then produces an account of what Kendrick and Drew describe as reporting a trouble ("I can't get round") [18, p.6].
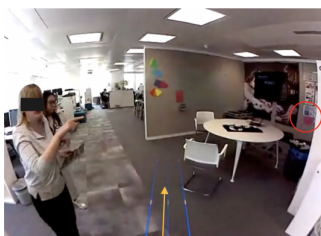
2a

1	R5:	Erm ((turning MRP)) I thought there was [one ((drives MRP forward)) over here.]
2	L5:	[One, two, three, four, five]
3	L5:	[((points at each paper))]
5	R5:	[　　　　　　　Yeah]
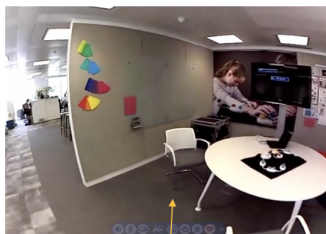
2b

5	L5:	Oh, you didn't get that=
6	R5:	[=No. No. Cause I can't get. I can't get round]
7	R5:	[moves towards chair, stops in front of it]
8	L5:	<Ah>

2c

9	L5:	(1.28) Oh Right okay let me move the chair
10	L5:	((grabs and moves chair away from table))
11	R5:	Thank you

Fig. 2. Fragment 1: Remote (MRP) participant reporting a problem

The fragment takes places towards the end of their timed task. As seen in 2a, the remote participant is turning while saying "Erm. I thought there was one", and then starts to drive towards the table in front of the pink paper she needs to get to (indicated with a red circle) while saying "over here". As she is talking, the local participant starts counting the pink pieces of paper.

Notably, the local includes the target paper in her count. Earlier in the task, the local participant had pointed out that paper to her partner and, as we infer by her behavior in the present fragment, she assumed that the partner had managed to photograph it. With her beginning remark, "I thought there was one over here", the remote participant isn't really asking if there is a paper there (this is known by both participants). The remote participant had already been made aware if the paper and had made a failed attempt at getting to it (shown in Fragment 3). By remarking on it, by rendering it remarkable, she is drawing attention to it which initiates the recruitment of assistance directed towards it.

We also note that up to the point shown in 2b, the remote participant is facing the direction of two papers. Yet the local participant is able to understand which of the two is the target paper without further explanation. Perhaps because, of the two possible papers, the one in the back is the only one that is difficult to reach.

In 2b, the assertion "Oh, you didn't get that" suggests that the remote's prior utterance paired with her movement towards the table suffices to convey to the local that her partner has not photographed the target paper yet. Then, after confirming the local's assertion the remote participant offers an account of her physical imposition for not capturing the paper. Specifically she reports the trouble encountered by saying, "I can't get round". She follows this statement by moving towards a chair and stopping in front of it (her movement indicated by the yellow arrow in 2a and 2b). After a short pause, the local participant responds by moving the chair out of the way, so that the remote can drive the MRP around the table and reach the paper.

Further, note how the remote participant here combines verbal and embodied cues (such as driving towards the table paired with "over here" to convey the missing paper), succeeding in what might be called a relatively implicit way of communicating her need. Moreover, we can clearly identify in this recruitment sequence the use of reporting trouble, which according to Kendrick and Drew is not as explicit as a direct request but still on the explicit side of the scale. But this report of trouble is offered after the problem has already been understood by the local, as an account that the image wasn't taken, "I can't get round". This account warrants no further explanation, such as why this is the case exactly, or what might be in her way? All that is expressed more implicitly by her movement towards the obstacle chair, thus incorporating an embodied cue into the recruitment sequence. What this fragment illustrates is the importance of orientation, movement and embodiment 'in' the MRP in sequence with talk to recruit assistance successfully.

Other instances of trouble reporting included "I think I can not even get to the big screen", referring to not having the space to move so that the paper would be in the view of the main camera (as opposed to the small camera facing the floor) and "I cannot move".

In **Fragment 2**, next, we look at an instance in which assistance is provided by a local participant in anticipation - what Kendrick and Drew call a "projectable trouble"[18, p.9] on the part of the MRP participant. This kind of recruitment-assistance strategy was very common in our data (seven occurrences). In this case a different pair of participants are performing the task. The local participant has already informed his remote partner of another pink paper to capture ("there's one back there") and is asking her to follow him to its location. Just prior to this, L3 says "just turn" as the remote participant commences a turn leftwards, capturing one of the pink targets along the way ("so I got this one").

At first, we see the remote participant turning. She is shifting her gaze from facing the paper she just captured that is visible in Figure 3, 3a (circled in red, to the local participant's left hand side),

3a

| 1 | R3: | So I got this one? |
| 2 | L3: | ((raises hand, sidesteps away from R3)) |

3b

3	R3:	[And there is another one?]
4	R3:	[((turns to face L3))]
5	L3:	((raises right arm again))

3c

| 6 | L3: | =(If you follow me.) Yeah that you haven't seen |
| 7 | L3: | ((turns towards R3, moves chair and moves aside)) |

3d

| 8 | L3: | [[((raises arm and sidesteps away))] |
| 9 | R3: | [((moves forward))] |

Fig. 3. Fragment 2: Local participant projecting trouble

and is turning the MRP towards her partner as seen in both 3a and 3b. In the course of doing this turn, R3 is reviews her activity, making her capturing activity accountable to L3 ("so I got this one"), and in doing so showing both verbally and non-verbally that she's literally turning her attention to her partner.

During this turn, between 3a and 3b, L3 is intermittently side-stepping away from R3 whilst maintaining his gaze on the MRP. The turn of the MRP and the sequential placement of this action by R3 amidst their conversation and L3's side-stepping opens up the possibility, clearly oriented to by L3, that R3 will be following L3 as he leads R3 over to "another one". During this sequence, rather like a tour guide in a city, L3 also raises his hand, as if to further emphasise what they will be doing next, following him and moving "back there" in L3's direction.

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R3 then begins moving forwards, almost immediately after completing her question to L3: "and there is another one?". At this point, the local participant responds by asking R3 to "follow me". At this point, seeing the start of R3's movement towards him, L3 then steps forward and pulls the chair to one side, as seen in 3c-3d. He then returns to holding his hand up and continues side-stepping towards the next target whilst looking back momentarily to the MRP.

With the chair then out of the direct line of R3's initial movement forwards, she continues moving ahead with a minor amount of steering to still avoid the edge of the chair. R3 does not explicitly formulate a request for assistance, and instead she merely starts moving forwards in response to L3's request to "follow me". In doing so, L3 projects trouble with the position of the chair and R3's trajectory of movement. The incident passes unremarked upon, yet nevertheless, R3's response to L3's suggestion that there is another pink target to capture occasions L3 to deal with troubles before they explicitly arise. The remote participant indicated, through her gaze and speech, that she was willing to follow him and the chair was in the path that she would take if she did follow.

We noted that the local participant lifts one arm up, as seen in 3b and 3d, similar to a tour-guide ensuring that he can be seen. This might suggest that he is unsure of whether he can be sufficiently seen or heard by the remote user without doing this extra work. His 'unnecessary' work (in some sense) in becoming more visible thus revealing some suggestion of a lack of certainty about how visible he actually is to the MRP participant. This leads us to note that this fragment illustrates a range of asymmetries in MRP use which play a significant role in the manner of recruitment and assistance.

4.2 Dealing with asymmetries when recruiting assistance

Successfully recruiting assistance or being provided with anticipatory forms of assistance in response to projected troubles were not always present in the task as it unfolded between the remote and local participants. In many cases there were problems with either getting help in the first place, or in the manner of projecting trouble (such as troubles which are misjudged, or do not ultimately emerge). The following two fragments describe moments that are less successful and offer 'inverse' cases of the first two.

We join **Fragment 3** just after R5 has captured a pink target. L5 has then asked R5 if she has seen the captured one, to which R5 responds positively. Still, there seems to be some confusion in whether what L5 is pointing towards is the target visible in Figure 4, 4a, circled in red. R5 then spots this particular target at the start of this fragment, just after L5 moves to the next bay.

Here, the remote participant spots the target ("what's that?") but at the same time cannot move closer due to an obstacle being in the way. Her question in line 1 remarking on this moment of spotting the target leads to nothing in return from L5. R5's attempt to recruit L5's assistance thus doesn't seem to be successful at getting the local participant's attention. It is worth remembering that R5's ability to 'see' is limited by the resolution and field-of-view of the camera on the MRP. R5's pause of 1.5s leads to her reformulating the question, this time questioning whether she should be closer to take the photo of the target ("am I too far away from that?"), the sense of which is built by the obstacle preventing her from getting any closer. After R5 produces this apparent question once again there is no response. After this point the remote participant reverses backwards, and turns to join L5 in the adjacent bay, ceasing to attempt to recruit L5 for help. Later on, in Fragment 1 which occurs a few minutes after this one, this same pair then return to this problem of whether R5 has captured all the pink targets, highlighting that this particular one has been missed, due in part, as we see here, to a lack of assistance from L5.

We note that as R5 approaches the obstacles, her exclamation (line 1) is designed in a more implicit linguistic form of recruitment. It does not articulate a trouble, and works more as a way

4a

1 R5:   [Oh, what's <that>?]

2 R5:   [((moves straight towards paper))]

4b

3 R5:   (3.29)

4 R5:   [Am I too far away from that? To take that?]

5 R5:   [((moves slightly closer towards paper))]

Fig. 4. Fragment 3: Example unsuccessful recruitment

of soliciting L5's attention back to R5's current activities. In that sense, it is a less explicit request for help, and is not building in any actual trouble into her utterance at this time (i.e., that there's a box in the way), or suggesting a solution or directly asking for help. Thus R5 begins by rather ambiguously stating what might be made sense of as trouble but could equally be heard as a broader curiosity.

After waiting in front of the obstacles and not getting a response, R5 makes another attempt with her reformulation of her recruitment of L5. This time her question, which is whether getting a photo of the paper from that distance would 'count', has a potential double duty. While it is available to L5, it is also available to the experimenter sitting in the room with her to her left, whom she has already asked a prior question regarding the MRP controls. Her utterance is also slightly quieter than the surrounding ones, however she does not glance at the experimenter this time, so it retains a more ambiguous character regarding who it is designed for. In any case, this is an instance where the question seems to act as an attempt at recruitment of either party, although it is not responded to.

Finally, she reverses straight backwards and then turns to the right to look for her partner. Ultimately, the remote participant abandons her attempt to capture this paper, and returns to it later in the task as seen in Fragment 1.

We note that given L5 has left R5's field of view in this fragment and is no longer talking, the remote participant has no way of knowing whether has been heard or whether her partner is paying attention to her. Attempts to deal with this lack of awareness is underlined by her changes how loud she is speaking; there are some mild variations in volume of her utterances that suggest some distinction between talking to L5 and talking to the experimenter, although as we noted, line 3 is ambiguous. Furthermore, R5 can only see straight in front and in order to look for her partner she has to move the entire robot out of that position and then turn around (which she eventually does). This example then showcases how restricted movement flexibility and limited access to

information about what is happening in the local environment (including whether local persons are in ear-shot and displaying attention) sometimes prevent the remote user from effectively asking for help.

In **Fragment 4** we now present a different type of 'unsuccessful' recruitment. As we showed earlier (in Fragment 2), the local participants often projected troubles as they emerged, leading to them providing assistance without the remote having to do anything. Here, we see the local participant projecting one such trouble—specifically what the MRP participant can and can't see— and then beginning to offer help where it seems unwarranted. This shows us just how difficult it can be for the local participant to judge what kinds of assistance might be needed. At the start of this fragment, R8 has spotted a pink piece of paper is driving towards the target (Figure 5, 5a).
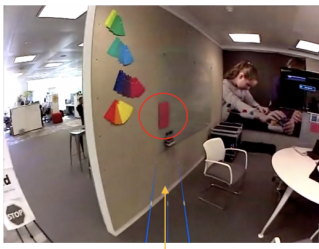
5a

| 1 | R8: | ((moves towards pink paper and stops in front of it)) |

5b

2	L8:	On the left hand side there's a pink bit of paper Chris I don't know if you can see it
3	R8:	Is is it the one I'm looking at now?
4	R8:	((turns gaze towards partner))

5c

| 5 | L8: | Yeah it is |
| 6 | R8: | Yeah got it okay yeah |

Fig. 5. Fragment 4: Unsolicited projectable trouble

R8 stops in front of this pink target in order to capture it (5b). However, the local participant at this point informs him about the paper ("on the left hand side there's a pink bit of paper"), which has been visible in R8's video stream for some time, and that R4 has been quite clearly piloting his MRP towards ('clearly' from the perspective of viewing R4's video, that is). In line 2, R8 checks that the pink target he is in front of is indeed the same as the one referred to by L8, which also acts as a way of acknowledging L4's assistance even if unnecessary. We also point out that L4 does seem oriented towards the possibility of this assistance to R4 being unneeded by downgrading his observation with "I don't know if you can see it".

In this scenario, the local participant was not able to make an accurate assessment of the situation, particularly in appreciating what R8 was driving towards or what was within his vision. We note that in the recording, R8's final movement towards the wall maintains the pink paper almost entirely in the centre of the screen, although of course the directionality of this is not available to L8. It is possible that L8 did not see the Beam move towards the paper (5a) but only saw the Beam standing next to it (5b). Even then, by his utterances, L8 does not seem able to tell how well his partner could see through the Beam from this stationary point, and whether he could make out the paper in front of him. Once again, this is supported by his hedging "I don't know if you can see it".

Now, this is not necessarily a problematic interaction. Indeed the remote participant smiles and moves on without taking offense and instead builds a response (line 2) that simply confirms matters. Given the circumstances of a short-term collaboration for a timed task, it is probably a good strategy for the local participant to offer assistance even where there is uncertainty about its necessity, so as to ensure they get all the papers rather than spend more time figuring out the MRP

partner's exact capabilities. Still, we can imagine that sustained incidents of unsolicited help such as this in long-term collaborations may be heard as patronising and place the remote user in an unfairly subordinate role. Further, this scenario highlights how lack of knowledge about MRPs on the part of local users can also be an obstacle to smooth interactions.

4.3 Trouble reporting as status reporting

Throughout the task, both remote and local the participants would verbally report on what they were doing, perhaps as a way of updating each other on the status of the search task when they were working separately (the office space in which the task took place was not large and overhearing a distinct possibility). In a similar manner, we found that the remote participants also developed a practice of reporting trouble out loud as they encountered it, but without apparent expectation of the local then providing assistance (given differences in participants' exhibited orientations to such utterances). Often these utterances concerned the limitations of the Beam as the remote participant came across them during the task. Sometimes troubles were formulated as apologies: for instance, some examples from our data include "I feel very conscious of hitting stuff" and "It's kinda slow backwards", as well as more humorous remarks about lack of Beam speed, "Is there a run key?" and "I'm racing against time!".

In **Fragment 5** we look at just one instance of what we might describe as a 'status reporting' practice that articulated trouble but not treated as needing assistance. In this fragment, the remote participant is moving around a table and stools in order to reach one of the pink targets having identified it with L4 and pre-empted their subsequent action with "I'll go to that one".

As R4 turns around the table, in Figure 6, 6c, he sees a stool in his path and reports this with a developing level of specificity, beginning with "umm" and then "but there's some obstacles here". As we saw in Fragment 1, this kind of apparent reporting trouble is a strategy participants often used to get their partner to provide the help they needed. In this case, however, the Beam pilot seems to be doing something different regarding how both he and L4 are treating this trouble report. Firstly, R4 carries on with his movement around the stool, L4 does not respond to R4, and R4 does not then do any remedial work. For example, R4 does not wait for his partner to respond, or repeat the report of trouble, reformulate it, or upgrade it in any way (all of which suggest expectation of response), or produce some other account of 'trouble with articulating trouble'. In short there seems to be less expectation of the trouble's resolution. Instead, R4 simply continues to move around the stool, following his apparent trouble report with "yeah".

One possibility for this less demanding treatment of the trouble is that as R4's trajectory continues, and perhaps as the video stream reveals more of the physical space the Beam is in, the obstacle becomes less projectably problematic for R4 and therefore R4 does not pursue the trouble. Maybe— and we cannot tell from the video data—L4 himself also judges the route to be within the capabilities of the Beam and therefore does not intervene (although he also does not indicate that 'it's all fine' either).

This behavior may be comparable to [14] where participants in virtual meetings verbally reported on their actions in order to overcome the barrier to symmetry caused by their fragmented environment. As such, this may be an example of compensation work, performed by the remote participants to overcome their asymmetry, suggesting that they and local participants are aware of a fracture in the assumed reciprocity of perspectives.

5 UNDERSTANDING ASYMMETRIES IN ASSISTANCE RECRUITMENT

Our study showed the various ways in which recruitment and assistance emerged around troubles and were practically dealt with by local and remote participants. Of course, troubles encountered in MRP use must be understood here in the context of the experimental task. We found that
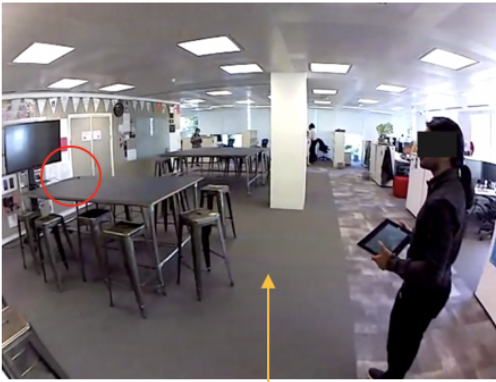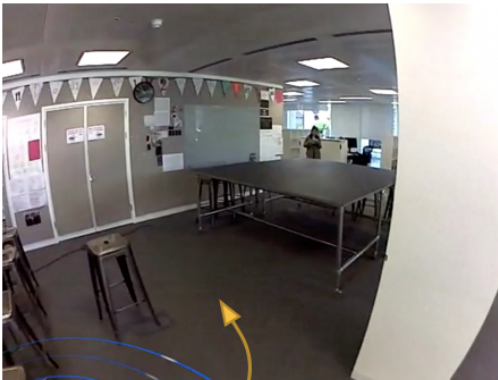
6a

1	R4:	[Okay so there's another one on the wall I can see there]
2	R4	[((turns towards the direction of the column))]
3	L4:	Eh, yup.
4	R4:	[So I'll go, I'll go to that one]
5	R4:	[((moves forward))]
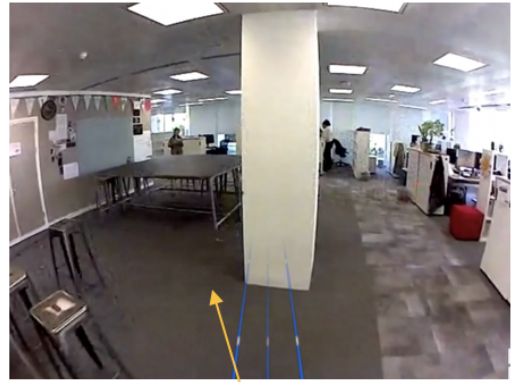
6b

6	L4:	Okay
7	R4:	Umm
8	R4	((turns around the table))

6c

| 9 | R4: | [But there's some obstacles here] |
| 10 | R4 | [((turns around table))] |

6d

| 11 | R4: | Yeah, (5.29) Okay |
| 12 | R4: | ((approaches paper)) |

Fig. 6. Fragment 5: Trouble reporting as status reporting

recruitment exclusively flowed in the direction of the local participant: we found no instances in our data in which the local participant instead recruited the remote participant for assistance. That caveat in mind, the explication of our fragments show time and again the physical limitations of the MRP, giving rise to asymmetries in the interaction that turn on the remote users' reliance on the help of their local partners. Here we will discuss the broader implications of these asymmetries from three perspectives: as asymmetries in mobility, perception and intersubjectivity. Then we turn to some remarks on the apparent social organisational preference for more implicit methods of recruitment from both parties over explicit, and in so doing reflect on politeness theory.

Table 1. Summary of Asymmetries

Topic	Asymmetry	Example in data	Related Literature
Mobility	movement flexibility	Fragments 1, 2, 3	[13, 22, 23, 27]
	move items in space	Fragments 1, 2, 3, 5	[1, 20, 25, 29]
	movement speed	Fragment 3	[8, 13, 20, 22, 25]
Perception	sense location of others	Fragment 3	[13, 15, 20, 22]
	sense own sound volume	Fragment 3	[8, 20, 25]
	sense own appearance	Fragments 3	[1, 20, 22]
Inter-subjectivity	monitoring others' focus of gaze	Fragments 2, 3, 4	[13, 20, 23, 25]
	monitoring others' hearing ability	Fragment 3	[20, 23]
	assessing others' movement ability	Fragment 1, 3, 5	[20]
	assessing own ability	Fragment 5	[14]

The concept of asymmetries, as reviewed earlier, emerged in the context of traditional video-conferencing and virtual environments [e.g. 14]. The physical autonomy afforded in MRP may at first glance appear to address some of the asymmetries, for example by giving pilots a physical embodiment, one that they can manipulate through turning (to suggest something akin to 'gaze') as well as the ability to move around in a space. But our findings show that asymmetries nevertheless stubbornly persist in MRP. These asymmetries are fundamentally phenomenological differences between local and remote. However, although such 'subjective' differences are ultimately foundational in the routine organisation of everyday life (i.e. intersubjectivity), the experiment here helps highlight more significant fractures in intersubjectivity before they might have become accommodated and managed by either parties. It is not necessarily that such fractures are problematic—the participants typically found some way or other to overcome trouble—but that their contours are substantively different and, we contend, mostly as yet lie unarticulated in the MRP-related scholarship.

In order to kick-start a process of trying to articulate these, in Table 1 we have summarised the asymmetries present in our data. We also want to discuss these asymmetries in relation to the three broad topics they tend to, in conjunction with some of the literature that has touched on the respective topic.

5.1 Mobility-related asymmetries

Generally, the MRP is slow, less able to navigate narrow passages due to its bulky base and is not able to manipulate objects, such as to move them out of the way. These limitations are well known in the literature [1, 8, 13, 20, 22, 23, 25, 29]. Indeed, in most cases where we saw recruitment and assistance in the data, the trouble was related to moving around in the environment (Fragments 1, 2, 3 and 5). This may be seen to create a dependency for the remote user, perhaps creating an awkward dynamic for the dyads, especially for participants simply not very familiar with each other. From the perspective of politeness theory, there is potential for face threat, which might lead both parties to tread carefully by being indirect in their assistance recruitment methods. We will discuss this further below.

Whilst not specifically exploring asymmetries the observation of 'imbalance' between remote and local people has come up in other MRP studies. Takayama and Go, who examined the metaphors in talk about MRPs observed the treatment of remote users is sometimes comparable to that of people with disabilities. Both parties in those instances have noted feeling awkward about the

remote user's need for assistance and how to address it (e.g. for having to hold the door open at the end of a meeting) [25]. Imbalance due to dependency is also mentioned by Yang et al. (2018) who observed couples shopping, where one member participated via an MRP [29]. Couples reportedly felt a shift in their dynamic, as now the local partner lead the activity (despite the remote also having autonomy). Remote participants in a geocaching task done in pairs also felt dependent on their local partner, and unable to contribute equally to the task. Local participants in that study were not aware of this imbalance [13]. This issue seems especially problematic given that MRPs are sometimes touted as ways for people with disabilities to increase access and participation [e.g. 5, 26] however MRPs may also further reinforce existing experiences of structural barriers.

Moreover, the mobility of the remote user, unlike in traditional video-conferencing, can be leveraged for embodied communication, such as physical pointing. For example, in Fragment 1, by moving towards the chair the remote user communicated to her partner that the chair was in the way. At the same time the limited mobility coupled with an expectation of good mobility can be troublesome. In Fragment 3, for example, the remote user was not able to move fast enough to effectively get her partner's attention. The local may have been expecting the remote user to be able to move around and thus was perhaps less attentive to them. As Tsui et al. point out, it would be useful for MRPs to be able to turn their head or torso independently, as that would enable the remote user to more effectively do a visual search and locate their partner without having to move the base [27]. Thus, the limited mobility of the MRP also impacts perception as we will discuss in the following.

5.2 Perception-related asymmetries

Asymmetry in vision and overall perception can also be obstructive. Unlike the local participants, the remote users of MRP have limited (mediated) perceptive capability of sound and vision, limiting their ability to sense the location or movement of others in the environment [13, 15, 20, 22]. In our data, for instance, pilots had trouble distinguishing red from pink, as many mistook a small red poster for one of the pink papers they were searching for. They also did not have any feedback on how loudly their voice was being projected; a problem often reported in the literature [8, 20, 25]. In addition users have reported having difficulty knowing how much space they occupy and whether their MRP is in someones' way; again such trouble with one might call 'mediated proprioception' has been reported in related work [1, 20, 22]. This asymmetry in perceptual abilities can be another obstacle in recruiting assistance, as it limits the remote users' feedback on the effectiveness of their actions.

This is demonstrated in Fragment 3, where, lacking feedback, the remote participant does not adjust her strategy and ultimately fails to get help. We see that the remote participant's initial attempt at getting help ("Oh, what's that?") does not elicit a response from the local participant who may have not heard the remote. In that situation, the remote user is not able to see or hear her partner. Restricted movement also does not allow her easily inspect (e.g. by glancing) the local activity space and get that information. As a result, the attempt at assistance recruitment is unsuccessful. Had she been able to see where her partner was and what she was doing, she might have been able to adjust her strategy in time and get her attention. However, to gain this information with the current limitations of the MRP, she would have needed to reverse backwards and then turn the MRP. This would have taken time while also having to move away from the location of the trouble. Indeed, when she does reverse backwards and finds her partner she is not able to bring their attention back to the uncaptured image at this point and both participants move on with other parts of the task.

5.3 Intersubjectivity-related asymmetries

There is also an asymmetry in intersubjectivity—bridging subjective experiences to achieve mutual understanding—for the local and the remote participant.

More so than when people are co-located, each party has trouble monitoring what the other's perspective might be, and accordingly what the other might have understood. For instance, the local participants have limited access to what and how well their remote partner can see and hear. This was evident in our data set as local participants often made remarks such as "I don't know if you can see X" and "can you hear me?". In Fragment 2, the local participant raises his hand, possibly aiming to make himself more visible to the remote participant, suggesting he is also not certain of how well he can be seen, and perhaps even could be described as overcompensating. It is further manifest in Fragment 4, where the local points out to his partner the pink paper, not realising that the remote user was already looking at it.

As we have noted above, the inability to understand each other's perspective has also been identified in other MRP studies. Takayama and Go found that while both remote and local users alternated in describing the MRP as a robot and as a person, there was often a mismatch between the two parties during a given interaction which reflected in how people treated the MRP [25]. Yang et al. also found a mismatch in users' sense of responsibility in a study of couples shopping with one partner joining via MRP. While the remote partners claimed it would be their responsibility if they broke something in the store, the local partners also felt responsible for their remote partners' actions [29]. The authors suggest that while the piloting the MRP gave remote users a sense of agency this was not recognised (to the same degree) by their local interaction partners. Local participants in that study also felt responsible for helping the remote partner, and even did so at times when the remote partners found it to be unnecessary [29].

Rae and Neustaedter, in a study of MRP use in conferences also describe several incidents that may be related to asymmetry in accomplishing intersubjectivity [23]. Remote users at the conference reported often colliding with local attendees as they were unable to tell them that they were passing through whilst at the same time they were not aware that they were failing to do so, and may have expected local attendees to move aside. They also report an incident of 'accidental eavesdropping', as local attendees were speaking near an MRP, not realising that its remote user could hear them. Finally, they observed instances of the local attendees being rude and even abusive towards the MRPs. It is possible that difficulty in assuming the perspective of the remote users plays a role in such antisocial behaviour.

As a result of this asymmetry users might be inclined to do extra work as a way to cover gaps that might be caused due to their lack of understanding. A well-known phenomenon, this kind of 'compensation work' has been observed since early studies of virtual environments [14]. In our data remote participants did this by reporting on their limitations as they went about the task, maintaining awareness of their perspective as way of compensating for the asymmetry (Fragment 5).

5.4 Recruitment is typically implicit

In our data set we observed a preference for relatively 'implicit' methods of recruitment. Specifically, participants mainly made use of trouble reporting (e.g. Fragment 1) and projecting trouble (e.g. Fragment 2). Despite the time constraint, they did not at any point make requests for help that we might describe as explicit, linguistically: for example, moving beyond the trouble to suggest a method of its resolution such as "can you move the chair?" or "can you help me get there?". Instead, remote participants simply reported what trouble they were experiencing and allowed their partner to formulate a resolution for it (or perhaps ignore the recruitment attempt). At the same time, local

participants appeared to consider their partner's mobility limitations as they frequently observably anticipated when trouble avoiding obstacles might arise and responded to it in advance whenever possible, such as by moving furniture out of the way.

In conjunction with a preference for more implicit strategies we also see that certain phrases and actions used by the participants build in a sense of uncertainty in what the other can hear or see. In Fragment 1, the local participant at first expresses uncertainty on what her partner said ("Oh, you didn't get that?") and then pauses before offering help. In Fragment 2, the local participants raises his hand, but still hesitantly keeps it close to his head, to better get his partners' attention. In Fragment 3, the local participant follow his assistance with "I don't know if you can see it." Indeed, statements such as "I don't know if you can X" were common from local participants.

Studies examining remote and co-located help giving have observed that queries for help are often "specifically vague", and that systems to support such help giving practices should support articulation work through which help is ultimately sought and provided [6]. The embodied nature of the MRP does appear to provide certain features that support implicit recruitment (such as 'driving at' to 'point'), enabling a more subtle, expressive asking for help than, for instance, remote gestures in videoconferencing [19].

Politeness theory might cast the preference for implicit requests as a strategy for participants to save face, with the remote users not wanting to impose and the locals not wanting to seem inconsiderate. But this ignores the interactional element of how recruitment and assistance played out, and the play of various asymmetries in operation. Such asymmetries and their emergence at particular moments of interaction is fitted to the moment, e.g. Fragment 4's patch of misjudgement by the local about what the remote could see. It is unclear how this has much to do with e.g. embarrassment over losing face, when there is no empirical evidence for such a thing (e.g. topicalisation by participants). In addition, as previous literature has suggested, indirectness on the part of the requester could be a result of a low sense of entitlement to make the request [7, 12], which itself is also established in a sequence of interaction rather than as part of static intrinsically 'entitled' language. However, more evidence would be needed before we can draw such conclusions.

Next, we discuss potential future topics for MRP research.

5.5 Future Research

The experimental situation in which our data was produced cautions us against drawing broad conclusions. Instead, future work should explore assistance recruitment in less restrictive situations and look at naturally occurring interactions in order to observe the actions of people in other 'real-world' settings. For example, looking at long-term use in workplaces where some co-workers are remotely present in MRP would be valuable so as to observe users who are already familiar with each other and perhaps more comfortable communicating (and requesting), and who may also be motivated to preserve a good working relationship over time. Observing long term use will also allow us to study how the asymmetries and recruitment methods evolve over time. It would also allow studying which barriers may be overcome, for example by developing workarounds, and which barriers may remain more thorny even after co-workers become familiar with the MRP.

It seems particularly pertinent, at a time in which more of the workforce is forced to explore remote working, to pay close attention to the potential social imbalance that may be created on a micropolitical level between a local and a remote workforce [4]. This has for instance been discussed by Cahill and Eggleston in the context of wheelchair users' assistance requests [3]. They suggest that when a person on a wheelchair is required to ask for and accept assistance, they inevitably place themselves as subordinate to the other. The other in turn, by providing the assistance, places themselves as superordinate. Although beyond the scope of this paper, some aspects of our findings on asymmetries between local and remote participants may be read as practical instantiations

of such micropolitics. The high frequency of assistance initiated by the local participants (e.g. by projecting trouble in Fragment 2) might also suggest a sense of responsibility to help their remote partner who was 'restricted' by the MRP. Future work on telepresence should specifically consider this angle of assistance recruiting and such 'unintended consequences', before MRP can be whole-heartedly recommended as a solution for equitable remote working.

5.6 Limitations

It is important here to note that these findings should be understood as a production of the given circumstances. The participants were engaged in an experimental collaborative task, with an explicit reward for their performance; an experimenter was also copresent. It is safe to say that it should have been evident to them that it was in their best interest to help each other as much as possible in order to find all the items within the time limit. As such, the task-based situation determined that recruitment of assistance was 'par for the course'. Providing as much help as possible in the moment and voicing every potential problem that arises (even if not all of them will require recruitment) might have been better options in the interest of the short-term goal of finishing the task on time. Colleagues who work together regularly, know each other better, and are motivated to maintain a good relationship might have used different strategies, or opted to recruit and provide different kinds of assistance. In addition, future work may wish to examine interpersonal and cultural factors influencing preference for implicitness, which are beyond the scope of this paper. Moreover, the observed asymmetries might be to some degree situational, depending on the users' familiarity with the MRP. More experienced users may still not have a perfect understanding but it might be improved. Therefore, we caution that further work is required to substantiate the nature and impact of asymmetries in other kinds of settings involving MRP interaction.

6 CONCLUSION

In this work we have closely examined the interaction between local and remote MRP-piloting participants working together in a collaborative search task, focusing on just how remote users recruit assistance from local participants. Drawing on Kendrick and Drew's framework of assistance recruitment in face-to-face settings, our explication of MRP-mediated assistance recruitment draws attention to the interactional asymmetries in mobility, perception and intersubjectivity that participants face.

Studies like ours that examine how assistance recruitment is achieved can reveal underlying nuances of the situation. For instance, are people comfortable asking for help, do they feel entitled to it? Do local colleagues feel responsible to help? Unpacking these processes can also highlight what barriers exist that make communication harder. A focus on understanding what communicative asymmetries exist can also allow us to asses not only what kind of help might be required but also how easily it can be recruited.

As remote working becomes more common, it will be essential to ensure that remote workers using MRPs are able to effectively recruit the assistance they need. In so doing, we need to be mindful that requesting help and receiving assistance may create imbalances in organisational structure. Beyond the immediate issues that remote users face in assistance recruitment, questions of who 'has to' work in the workplace versus who 'gets to' work from home and what that means to recruiting help etc. ought to be considered in terms of how they may entrench structural inequalities. Thus, a wider sense of a range of 're-balancings ' may become relevant in the post-pandemic world of work. For instance, care should be taken, not only to ensure that remote workers can receive help, but also that doing so does not harm their position and how they are perceived in their workplace.

To conclude with a more concrete take-away message for the CSCW design and research community, we feel that there is scope for wide-ranging changes to reduce the impact of asymmetries

for MRP users. These may range from improved features in the MRP, to providing information not just to remote users but to those local to the MRP to raise awareness of inequality issues, to campaigns on etiquette to inform the community, to developing tutorials for workarounds to alleviate the impact of asymmetries, to guidelines for considerate and responsible conduct around MRPs. The CSCW community is well-placed to conduct research to understand how to alleviate some of these problems arising from asymmetries, reducing imbalances and making it easier for remote users to request and receive help.

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