

# Conversational Management of Network Trouble Perturbations in Personal Videoconferencing

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## ABSTRACT

Domestic personal videoconferencing (PV) is vulnerable to network trouble perturbations. This paper shows that long-distance couples treat perturbations as a matter of social management as much as technological resolution. Three management strategies are illustrated: technology-oriented remedies, content-oriented remedies, and non-remedial accounts for trouble. All three involve collaborative work to account for the effect of technology on conversational continuity and the relationship.

## Author Keywords

Personal videoconferencing, conversation, continuity, network trouble, novices, couples, domestic, home users.

## ACM Classification Keywords

H.4.3. Information systems and applications: Communication applications: *Computer conferencing, teleconferencing, and videoconferencing.*

## INTRODUCTION

End-users consistently report strong feelings about technology failures. The Pew Internet and American Life Project reports that 59% of users feel impatient resolving technology problems and 48% feel discouraged with the amount of effort required (Horrigan & Jones, 2008). But what actual practices lie behind both the negative feelings reported and the unreported successes? This paper investigates one small slice of this issue. Domestic personal videoconferencing (PV) among long-distance couples is an increasingly mainstream activity (Bell & Brauer-Bell, 2006). However, limitations of home networking leave PV vulnerable to distortion, drop outs, lag, and desynchronisation. This paper illustrates how long-distance couples trying PV for two months coped with network trouble perturbations as problems for maintaining conversational continuity.

Quality-of-Service (QoS) research on user difficulties tends to elide the users' perspective. Lu et al. (2010) contrast network differences among consumer videoconferencing services, but not users' perceptions. Hashimoto & Ishibashi (2006) report that latency annoys players in videoconferenced rock-paper-scissors games, but not the players' practices for managing latency.

User-focused videoconferencing research has investigated issues related to network trouble, such as the effects of

audio and video constraints. A poor quality video link makes speech less fluent (Monk & Watts 1995), makes it harder to detect lying (Horn, Karasik & Olsen 2002) and increases caution (Jackson, et al., 2000). Preserving motion seems essential for user engagement even if that means reducing spatial and colour resolution (Schiano, Ehrlich & Sheridan 2001). Users prefer instantaneous audio transmission, even at the cost of desynchronisation (Isaacs & Tang, 2001), and are very sensitive to audio degradation (Watson & Sasse 2000). While the experimental results are rich, data on actual user practices is more anecdotal (e.g. Dourish et al. 1996). Transcribed observational data is rare. Heath & Luff (1991) illustrate asymmetries in getting attention in a media space with manually operated audio. Ruhleder & Jordan (2001) demonstrate that the causes of many users' discomfort with videoconferencing are subtle distortions introduced into interactional timing. Both cases, however, are from work contexts, which have received the majority of research attention together with the work-to-home context of telehealth (e.g. Latifi, 2008). Although relationships have been central to Computer-Mediated Communication research (Walter, Gay & Hancock, 2005), research on PV in long-distance relationships has focused mainly on the family (e.g. Yarosh, 2008). However, a recent point about family videoconferencing research is critical to this paper. Ames, et al (2010) argue that the effort required to initiate, run, and troubleshoot family PV has been largely hidden from, or treated as unimportant by, researchers.

It sum, PV network trouble is not well understood from the users' perspective and transcribed observational data is rare. This is especially the case for long-distance couples. Couples are an interesting group because their relationship motivates continuity of PV use, but they must manage trouble with little or no aid and as a part of their relational work. This paper uses transcribed conversations to argue that managing PV network trouble perturbations is collaborative conversational and relational work. This work is characterised by a focus on the intersection of technological and social accounts for conversational continuity.

## METHODOLOGY

Six long-distance couples were recruited to try PV, in their homes, any way they wished, for 20 minutes a week over a two-month period. The number of couples was predicated on Neilson & Landauer's (1993) metric that five users catch around 80% of usability problems. Recruited by printed and online flyers in the Northeastern USA, the six couples were comprised of self-selected native English speakers, under 21, college-educated, and primarily white. This cohort is not representative of the

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US population, but they are well-resourced members of the highly mediated Millennials (Taylor & Keeter, 2010). As such, their reactions in this project may be the future of mainstream users' understandings of technology.

The couples, all PV novices, were supplied with webcams and PV software to use with their existing home computing ecology. Apart from minimum standards for hardware and broadband Internet access, there were no controls, so that network trouble would occur and be dealt with as naturally as possible. All conferences were recorded remotely (Figure 1) with the couples' consent and all names have been changed in the transcripts.

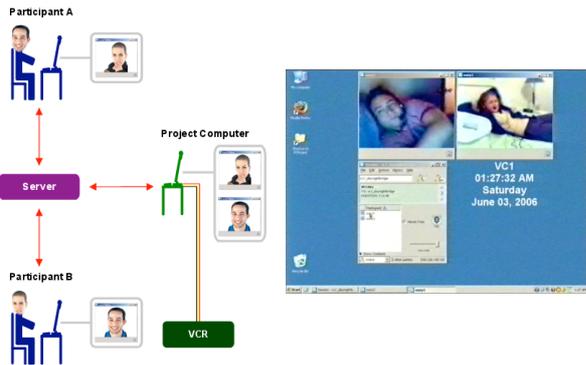


Figure 1. Remote recording set up and screen layout.

The recordings were analysed according to the precepts of Ethnomethodology (EM) and Conversation Analysis (CA). EM/CA have carved out a niche in HCI research through their attention to the ways in which people engage with technology (Dourish, 2001). EM/CA investigate how social action is a situated and sequential achievement. Turns are treated as proposing slots for next actions and next turns ratify, modify, or resist the understandings of prior actions (Clayman & Gill, 2005). EM/CA claim validity on the basis that regardless of the status of cognition, understandings must be shared and acted upon interactionally. As such, researchers can access participants' shared understandings in ways similar to the way participants access each other's understandings. Transcripts provide a record of those shared understandings for researchers and readers alike (Key available at <http://preview.tinyurl.com/transkey>). The examples used in this paper come primarily from one couple because their cases are conveniently compact, but they are representative of all couples' practices.

### FINDINGS

The couples had 5 to 11 conferences each, in which 145 network trouble cases were located by searching for conversational repairs. Three couples spent less than 5% of their trial coping with perturbations, two spent between 11% and 15%, and one couple spent an enormous 42% (Table 1). This leaves the median 8% as the best central measure, although it is not claimed to be representative of home PV. The differences were due to the idiosyncrasies of the couples' home computing ecologies, sometimes due to wireless connections (K&D, E&H) or ISP upload bandwidth throttling (R&S, K&K).

Confs.	Total talk (Mins)	Total cases (Count)	Total cases (Mins)	Proportion of couple's talk	
D&K	9	520.8	53	60.99	11.7%
E&H	5	153.0	36	64.30	42.0%
A&T	6	161.0	5	6.78	4.2%
R&S	10	511.3	30	76.27	14.9%
K&K	11	477.0	15	18.71	3.9%
O&J	7	217.8	6	7.82	3.6%
Total	48	2040.8	145	234.9	
Mean		583.1	41	67.1	13.1%
Median		347.4	23	39.9	8.0%

Table 1. Proportion of trouble in couples' trials

Despite being briefed on using Session's bandwidth controls to reduce perturbations, technology remedies were only one of three categories of reaction: technology-oriented remedies (39.3%), content-oriented remedies (29.7%), and non-remedial accounts (31%). These reactions were highly variably distributed between couples (Table 2). The couples also oriented far more often to audio or combined audio/video perturbations than video perturbations alone (Table 2). Reactions to video perturbation tended to be non-remedial. Even the couple that was most oriented to video perturbation (R&S) reacted non-remedially in half of cases (Table 2).

Reaction	Trouble	K&D	E&H	R&S	K&K	O&J	A&T	Total %
Tech. remedy	Aud	9	5	1	2	4		21
	Aud/Vid	8	5	1			2	16
	Vid	3	2	11	3	1		20
TR Total		20	12	13	5	5	2	57 39.3%
Content remedy	Aud	20	13	1	3			37
	Aud/Vid		3					3
	Vid		1	1				2
CR Total		20	17	2	3			42 29.0%
Non-remedial	Aud	9	4		3		1	17
	Aud/Vid	3	3					6
	Vid	1		15	4	1	2	23
NR Total		13	7	15	7	1	3	46 31.7%
Gr. Total		53	36	30	15	6	5	145

Table 2. Trouble and reaction type breakdown by couple

The outcomes of reactions are clearly very important issues but space precludes their coverage in this paper beyond two brief points. First, all the couples found ways to maintain conversation no matter whether they succeeded or failed to resolve the perturbation. Only one couple, once, abandoned a conversation due to perturbation, and that was after 20 minutes of trying to talk. Second, couples that had difficulty with technological solutions early in their trials tended to abandon that approach, while couples that had early success often continued to use them. The remainder of this paper illustrates conversational practices used to invoke and account for technology-oriented remedies, content-oriented remedies, and non-remedial reactions.

### Technology-Oriented Remedies

Technology-oriented remedies involved the participants treating continuity as a matter of the manipulability of the technology (usually the bandwidth controls, sometimes workarounds such as restarting) to re-establish the ability to communicate, but not necessarily the concomitant content of disrupted communication.

### Technology-oriented remedy for audio perturbations

Severe audio perturbations were often formulated as trouble with the connection rather than missing or distorted content.

#### Example 1.

1. KAY: Sorry. You know what you need to buy me?  
2. DES: @Adjusts webcam, pixelates@ What?  
3. KAY: That's good  
4. KAY: {A [computer fan]}  
5. DES: [It's choppy ] I can't hear you anymore  
6. KAY: /Yawns/ @Holds mic to mouth@ co:mpu:ter: fa:n  
7. DES: @View of stomach, pixelated@ Oh you need one?  
8. (1.5) Y-{ }  
9. KAY: @Nods@  
10. DES: Okay @Looks away@  
11. KAY: What are you looking at? You {{{ } } too?  
12. DES: Shh @[Adjusts webcam, pixelates@  
13. KAY: What are you doing?  
14. DES: Why are you so choppy? @[Adjusts webcam  
pixelates@  
16. KAY: Wha-? I'll change it then  
17. DES: @View of stomach@  
18. KAY: E(h)e(h)w (laughs)  
19. DES: (laughs) @Face close up, pouting@ {0:h}  
20. KAY: What?  
21. DES: @Nose in profile, then eyes@  
22. KAY: Am I better now?  
23. DES: Yes=  
24. KAY: =(Des)  
25. DES: Perfect  
26. KAY: Yay  
27. DES: @Continues to show eyes in profile@  
28. KAY: Okay, I'm gonna go now[, talk to]+  
29. DES: [Wha:t? ]  
30. KAY: +someone who wants to talk to me  
[Case039-p01-c06of09-t11p1829-38m19in]

In Example 1, Des's two complaints (lines 5, 14) are about Kay's sound as "choppy". This is a negative evaluation of the sound quality, not a reference that locates particular content has having gone awry. Even when Des continues (line 5), he proposes an unspecified prior period of trouble, but not particular content from prior turns. However, while particular content is not proposed as troubled, Des's repeated complaints formulate ongoing conversation as difficult, which are implicit proposals to put the conversation on hold to address the connection issue. However, putting the conversation on hold does not entail a return.

Resolution of the connection trouble involves demonstration that the connection has been re-established more than repeating missed content or returning to the hold point. After Des's first complaint (line 5), Kay repeats what she said (line 6) and Des's response (line 7) indicates that he understood. Des's second version of the complaint (line 14) comes after two more turns from Kay (line 11, 13). Kay's reaction to Des's complaints is an elided proposal to manipulate the bandwidth controls (line 16), not a check on whether her prior turns have been understood. When Kay eventually checks on whether her manipulation has resolved the problem (line 22), Des confirms (line 23), even upgrades to a very positive evaluation (line 25) but then spends several seconds showing his eyes to Kay (line 27) rather than talking. Neither Des nor Kay follows up on the prior disrupted content. Instead, they move on to a new topic, treating the prior topic as complete (or not worth returning to) and, critically, treating the ability to continue as the most important outcome of the technological remedy.

### Technology-oriented remedy for visual perturbations

Limited video perturbations, such as pixellation or dropped frames, were either let pass or met with technological remedy, but not content remedy. Technological remedy for minor visual perturbations was treated as an issue of improving a sub-optimal connection way rather than re-establishing a disrupted connection. In Example 2, Kay's report of Des's face is produced in between laughs (line 2) and then followed up with an explicit attribution of the trouble to the connection (lines 5-6). Kay does not propose that she has missed any content and the problem is formulated as a tease, implying that the problem is minor. For Des, the problem is not that Kay has missed something he said. Rather, he is responding to the unflattering tease. As such, he proposes technological remedy to improve the sub-optimal connection (lines 7-8). His agreement is somewhat reluctant (line 8). His formulation of the action required as "turn up my quality" to fix the video implies that it has been turned down previously to deal with ongoing choppiness. As such, he is implying that this video fix may be detrimental to his audio fix and that the video trouble is less disruptive than the audio trouble.

#### Example 2.

1. DES: @Open mouth smile@  
2. KAY: (Laughs) You have no teeth (laughs)  
3. DES: @Opens mouth, lips over teeth@  
4. [Closes mouth@]  
5. KAY: [Your mouth is like so blurry ] it looks like  
6. it's sewed shut [(la)ughs] ]  
7. DES: [Alright] I'll turn up my  
8. quality it's still choppy I wish it was better  
[Case021-p01-c03of09-t11p3852-18m57in]

Frozen or non-starting video was also a candidate for technology repair, which usually involved restarting the application or rebooting entire. Space precludes inclusion of an example, but it should be noted in these instances, even when couples halted conversation for a restart/reboot, they almost never returned to the content that had been disrupted. That is not to say that returning to disrupted content is not possible or important to PV users, more that the move to technological manipulation may take over the conversation so much that it is easier to start new topics (and perhaps later return to the disrupted topic) than pick up where one left off.

### Content-Oriented Remedies

Trouble caused by technology does not necessarily require a technology-oriented reaction. Couples oriented to content when the perturbation was minor, such as a missing partial turn. Content-oriented remedy was materially framed by the participants' differing access to perturbations. Speakers do not directly experience perturbation of their own turns, only recipients do. Thus recipients can initially set the management agenda, orientation to either content or connection.

#### Content remedy without technological attribution

The simplest content-oriented remedy involved the recipient experiencing trouble to treat it like production errors, misspeakings, mishearings, or non-hearings in co-present or telephone interaction. This was done by requesting repetition/clarification of locatable content and not attributing trouble to technology. Given this initial content orientation, the most obvious response for the

repair recipient (who did not directly experience the trouble), was to provide the requested content also without technological attribution. Thus the recipient experiencing perturbation minimized both members' focus on technology and maintained the topic at hand.

**Example 3.**

```
1. DES: We made {__(0.5)}s for Boston(.)[Just tried]+
2. KAY: [You what? ]
3. DES: +to like- They tried to like plan out all
4. this stuff for Boston
[Case025-p01-C04of09-t11p3519-05m55in]
```

In Example 3, while discussing a recent meeting with friends, network trouble disrupts a referent in Des's report (line 1). Kay's repair initiator (line 2) interrupts Des at the nearest possible completion point of his turn (after the place name and a micro-pause), indicating that something immediately prior needs repair. Kay shows that she understands that a group of people including Des did some activity ("you") but needs the rest of the turn to make sense of that activity ("what?" line 2). Kay thus carefully locates missing content but does not bring up the technological cause of her repair initiation. We should not be surprised at this because her repair is fitted to the trouble. As opposed to the severe connection difficulties in Examples 1 and 2, which made all prior talk hard to hear, Kay has heard almost all of what Des has said, so in this case ordinary conversational repair practices avoid the needless complication of orienting to technology. In response, Des cuts off his turn in progress (line 3) and restarts from the place Kay indicated trouble (albeit with a different pronoun and some hedging) with the same basic content (lines 3-4). Des does not bring up technology—or any cause—because Kay has not raised it and because Kay has clearly located what needs repair. As with Kay, it would be needlessly complicating to propose that technology went wrong when the repair can be achieved with simple repetition. There are, however, some exceptions.

*Content remedy with technological attribution*

Technological attribution did occur in content-oriented remedies, but only if some aspect of the repair could be treated as ambiguous, either in terms of what was to be repaired or the need for repair. Participants' prior experiences entered such attributions. For example, recipients experiencing perturbation learned to use technological attribution to disambiguate repair initiators if past repairs had been difficult. On the flip-side recipients of ambiguous repair initiators learned to check whether the trouble was attributable to technology or some other problem. However, the technological focus was minimized because the technological attribution was only invoked to facilitate repair.

**Example 4.**

```
1. DES: Um:: someone can probably sleep on the
2. c{_____(2.5)}s three .h
3. KAY: Wait what?
4. DES: Someone can probably[ sleep]+
5. KAY: [ oh ]
6. DES: +on- did it
7. cut out?
8. KAY: Yeah
9. DES: Oh. Someone can probably sleep on the couch
[Case052-p01-c09of09-t10p5139-34m23in]
```

Example 4 shows Des explicitly checking on the possible technological cause of trouble to clarify the kind of repair that is required: either an easy content repetition or working through a more difficult social or moral problem. As part of making holiday plans, Des is proposing that a third person might stay on the couch in their hotel room (line 1-2). From Kay's perspective, a 2.5 second part of the turn about sleeping arrangements is dropped out (line 2). Kay initiates repair with (line 4). While "Wait" indicates an immediate need to halt, somewhat like her interruption in Example 3, the rest of the repair initiator ("what?") does not clearly locate the trouble. Indeed, it could be a simple hearing problem or it might indicate a social or moral problem with the idea of sharing a hotel room (and its attendant relational overtones). Des initially assumes that Kay missed part or all of his prior turn, and he begins to repeat the turn almost reflexively (line 4). At first, then, there is no sense of the technological cause of Kay's repair initiation. However, Des then second-guesses his repair. Three words into Des's repair (line 4) Kay overlaps the final word to indicate a change of state (line 5), a retrospective indicator of understanding the repaired turn. However, since Des is currently repairing his prior turn, he might hear Kay's overlapping change of state token as indicating there is potential problem with the repetition, and hence the correct repair may be of another kind. As such, Des catches himself and cuts his repair off to request confirmation of a candidate technological reason for Kay's repair initiation and change of state token (4+6-7).

Although Des's question projects confirmation, it also realizes the ambiguity of Kay's repair initiation. Given that they are planning vacation sleeping arrangements, it is possible that Kay is questioning Des's proposal to let someone sleep on a couch. This would be a problematic relational issue as opposed to the interactional issue of missing content. Providing a candidate technological solution allows Des to propose that the trouble is the simple missing content issue and not the more difficult relational issue. Kay's confirmation of Des's question (line 8) gives him the go ahead to repeat his initial proposal (line 9). That Kay's repair initiation "Wait what?" is not treated as ambiguous until Kay overlaps Des's repetition of the prior turn shows that the couple's understanding of trouble in the moment is not static or unilateral. It unfolds collaboratively, through proposals and ratifications that are sensitive to both sequential interactional practices and the relational context.

This case is taken from Kay & Des's final conference. It presents some interesting possibilities for the development of experience with PV. First, it is the speaker whose turn was perturbed (Des), not the recipient experiencing perturbation (Kay), who proposes candidate technological trouble. This might be evidence that Des has reached a sufficient level of experience with network trouble to assume that these kinds of interruptive repairs are usually caused by technology and involve missing isolated prior material. Although Des's cut-off allows for the possibility that the trouble was not caused by technology, his candidate indicates that he is fairly sure. Second, Des does not pursue technological remedy even

after receiving confirmation of a technological cause. This indicates that he may have reached a sufficient level of expertise to judge when technological troubles are worth pursuing technologically and when they are not.

#### *Content remedy for video perturbations*

Visual content was rarely the subject of content-oriented remedy. A significant amount of visual perturbation—frame drops, freezing, pixellation etc.—was let pass by participants without report or remedy. The only occasions in the data when visual content was subject to content-oriented remedy were when gestures were an explicit focus of some interactional business. While calling attention to a missed gesture is possible for any situation in which a gesture is explicitly enacted, in these trials attention to gesture was only attended to when the couple was oriented specifically to using PV to maintain their long-distance relationship.

Further, content-oriented remedy of visuals was the work of speakers checking on the uptake of gestures rather than recipients initiating repair based on missing the gestures. Recipients experiencing visual perturbation were quite insensitive to the fact that something visual had gone wrong, especially missing gestures. Since recipients experiencing perturbation did not know that there was something to miss they tended to respond to the last understandable verbal turn. Speakers, on the other hand, knew that they had performed an explicit gesture and then found recipients not responding to the gesture. Speakers on these occasions jumped to the inference that the gesture was missed, and checked on its reception.

Example 5 (which is actually the rest of Example 2) shows Kay teasing Des and following this with several winks to soften the tease. Kay treats Des's response as not quite adequate and checks on his uptake of the winks.

#### **Example 5.**

1. KAY: [Your mouth is like so blurry ] it looks like
  2. it's sewed shut ((la[ughter]))
  3. DES: [Alright ] I'll turn up my
  4. quality it's still choppy I wish it was better
  5. KAY: M:e too but it's not [. this is why]+
  6. DES: [Yeah I know ]
  7. KAY: +you can't date people far away
  8. [ @Smile, raises eyebrows@ ]
  9. DES: [ ((choked laugh)) ]
  10. DES: [ @Looking away@ ]
  11. KAY: [ @Exaggerated wink@ ]
  12. KAY: [ @Exaggerated wink@ ]
  13. KAY: [ @Disrupted exaggerated [wink@ ]
  14. DES: [Very ] funny
  15. KAY: Did you like that
  16. DES: What'd you do?
  17. KAY: @Exaggerated wink@
  18. DES: Did you wink?
  19. KAY: @Very exaggerated wink, extreme close-up@ Mhm
  20. DES: (laughs) Here u:m, oh [boy]
  21. KAY: [Can you] see that?
  22. (laughs)
  23. DES: Yes I saw that (.) [How do I look now?]
- [Case021-p01-c03of09-t11p3852-18m57in]

Des complains about choppy audio and wishes that PV were “better” (line 4). Kay responds with a teasing upshot to the complaint (“this is why] you can't date people far away”; line 5+7). Des's choked laugh (line 9) indicates amusement but also registers the negative relational overtone of the tease. To defuse her tease, Kay mugs at the camera with three exaggerated winks, the first two of which appear clearly (line 11, 12) while the third is

disrupted by network trouble dropping out middle frames (lines 13). Des's ironic assessment (“very funny”; line 14) is a continuation of his negative response to Kay's tease rather than a response to the softening winks. There are periods during lines 1-16 when Des is more clearly looking at Kay's image than others. Before he mentions adjusting the bandwidth he appears to be looking directly at Kay. Once he mentions adjusting the bandwidth he appears to be looking somewhat to his left. This includes the all the winks. At this time he would have been able to see Kay's image peripherally but may have been focused on the application's controls. However, even if Des were largely focused on the controls, given that frames were dropped from Kay's third wink, anything less than full attention would have made Kay's action much less visible, especially in Des's peripheral vision.

We cannot be sure why Des does not see the winks, but we can be sure that Kay's request for candidate positive assessment treats Des as not having provided an adequate or expected response to the winks (“Did you like that?”; line 15). By asking if Des liked the winks, she is less interested in an actual assessment of the winks' ‘likeability’ than Des understanding the winks as softening the tease. While this example shows inattention as well as perturbation, they are related issues. If a recipient does not respond to a gesture in an expected fashion, the speaker is likely to check on its uptake. Where network trouble could be of particular importance is that it could be mistaken for, or exacerbate, inattention. Thus in this example, we see that although only one wink out of three is perturbed, it is the last and most exaggerated in the series, and the one that was most designed to be seen after prior inattention to less exaggerated winks.

Example 5 is also interesting because this rare pursuit of visual content takes place within a larger instance of the couple explicitly orienting to two reasons for technology-oriented remedy: blurriness (line 1) and choppy audio (line 4). Technology-oriented remedy was explicitly on the table right before and after this instance, but in the moment, the visual issue of relational teasing was treated as an issue of content.

Of course, Kay does not know that the winks were troubled, only that she did not immediately receive the expected response and that she is trying to defuse a relational tease. What Kay does know is that Des is not treating the tease as jokingly as she has presented it. Since the tease is about the technological mediation of their long-distance relationship, Kay has a strong sequential and relational warrant to ensure that the Des understands her to have softened it. As such, lines 15 through 23 involve redoing the gestural softening in an over-determined manner, both in terms of directing Des's attention to the winking and the exaggeration of the wink.

#### **Non-Remedial Accounts**

One third of couples' reactions to PV network trouble did not involve attempts at remedy. This does not mean that participants ignored the trouble or its technological source. On the contrary, the common feature of these reactions was that perturbation was explicitly treated as a

noticeable connection problem, but allowed to pass. These included practices such as reporting without taking further action, checking the connection, testing for connection trouble (e.g. lag), complaining about trouble, assessing perturbation as not disruptive, and blaming the technology for social trouble. As in the other two reaction categories, non-remedial accounts were especially common reactions to visual perturbation, although they were certainly also used in cases of audio perturbation.

#### Letting visual trouble pass

Visual trouble was let pass when participants explicitly agreed that it was not disruptive. In Example 6, when Jed asks Ora to confirm the she sees blurry/pixelated video (line 2, 4), Ora confirms that she does but appends both an assessment that it doesn't bother her and the relational reasoning that the image is good enough for her to see what she desires of him (line 9-10).

#### Example 6.

1. ORA: @Arranging her wet hair@
  2. JED: Is my video blurry on your screen or does it
  3. look nice?
  4. ORA: Um::::[:.]
  5. JED: [Does it look pixelated?
  6. ORA: Yeah
  7. JED: Oh okay
  8. ORA: @Looks away towards door@
  9. JED: [So does yours]
  10. ORA: [It's fine ] It doesn't- it doesn't bother
  11. me it's fine. As long as I can see your
  12. beautiful face @smiles@
- [Case142-p06-c04of07-t09p5558-16m26in]

Jed's check (lines 2-3) provides Ora with a choice between two candidates, video that is "blurry" or "nice". When Ora seems unsure (line 4), Jed reformulates his check to make the question easier to answer. He provides just the candidate proposal of trouble to be confirmed or disconfirmed (line 5). He changes the formulation of trouble from "blurry" to "pixelated", ensuring that Ora orients to the lack of clarity as caused by technology, not some other form of 'blurry.'

Ora's first simple confirmation (line 6) treats Jed's reformulation as understandable and answerable, and does not mention any associated current content trouble or desire for technological remedy. Jed acknowledges Ora's confirmation (line 7), also without asking if it is causing her content trouble or proposing any technological remedy. With no further proposal from Jed, the floor is open for both participants to choose how to continue to focus on this trouble, specifically whether/how to attempt technological resolution.

When Ora does not immediately respond, Jed follows up with a report that he sees the same pixelation as Ora (line 9), but again without proposing that it is causing any current content trouble or proposing a technological remedy. In overlap with Jed's report, Ora specifically casts the pixelation as not causing trouble and acceptable (line 10). She extends this assessment to a normalization of the perturbation by showing that she has accepted its potentially negative valence ("It doesn't- it doesn't bother me it's fine"; line 9). Ora follows up this normalization with relational reasoning, emphasizing that the basis for her assessment is that the technological shortcomings of the visuals are to be judged against its relational gains

("As long as I can see your beautiful face @smiles@", line 11-12). The reasoning is also an implied statement of her general interactional preference. Being able to see Jed well enough (where that is a personal threshold) is more important than perfectly clearly. Not only can interaction continue during visual perturbation, but Ora also shows that it is easy for participants to provide each other with accounts for what can and cannot be seen. These accounts are crucial because they become part of a couple's collaborative standard for conversational continuity. Naturally, such accounts will be highly depended on context, in this case the long-distance relationship. They are also difficult to formulate outside times of conversational trouble and impossible to formulate unilaterally, because it is only in situated collaboration that they accurately reflect what will be counted as enabling continuity.

#### Letting audio trouble pass

Audio trouble was let pass if it did not have a practical effect on sequential turns at talk, even when attention was drawn to the trouble. In Example 7, Des asks Kay to participate in a test of lag (lines 10-23). The test appears to show that there is potentially severe lag (lines 21-23). However, the couple does not move to remedy, for two reasons. First, the apparent severity is not matched by actual perturbation. Second, the resolution phase of the test is disrupted by two accidents that show sequential interaction is working 'despite' the apparent lag.

#### Example 7.

1. DES: Ma:ybe (.) I think it's the bandwidth though.
  2. Oh you were you were good for a while now
  3. (1.5) you seem to be (.) not as delayed
  4. oh now it's delayed again (1.5) [hee hee ]
  5. KAY: [What's wrong?]
  6. DES: just the- the [lag ]
  7. KAY: [(( uch?))] What's the lag?
  8. oh yeah you had a problem with that
  9. @Rearranges pillows behind her@
  10. DES: Hey do me a favor
  11. KAY: [What ]
  12. DES: [As soon] [as I yell, yell back
  13. KAY: [@Arranges computer to face her@]
  14. DES: [Okay?]
  15. KAY: [Okay]
  16. DES: Ready?
  17. KAY: Okay, Uh huh.
  18. DES: Yah!
  19. (2.0)
  20. KAY: \Faint "Yah!"\ Yeah (laughs)
  21. DES: Oh man (.) it's like- there's like a five
  22. second delay on the text too (.) or the just-
  23. talking}
  24. KAY: What do you mean? Where did y- Where do you
  25. see the text?
  26. DES: No text (.) just talki- what are you doing?
  27. KAY: Blinking
  28. DES: I don't want to see your fo(h)rehe(h)ad
- [Case005-p01-c01of09-t01a1355-14m00in]

The details of how Kay & Des conduct the test are less important that its outcomes, suffice to say that in the context of discussing Des's dissatisfaction with lag (lines 1-9), Des produces an explicit preface (line 10) that sets Kay up to receive the next few turns as instructions (lines 11-20). After performing the test, Des reports the outcome with two senses of trouble: an implicit exclamation of shock (line 21) and then an estimated metric of "five seconds" that seems quite high and hence intuitively negative (lines 21-22). If Des had ended his test report at the end of his metric, he or Kay might have

taken the opportunity to transition from testing to remedy. However, in trying to include a description of the delay Des provides a mistaken referent “text” (line 22). He self-corrects to “talk” (lines 22-23) but Kay focuses on the initial mistaken referent (lines 24-25). As Des begins to repeat his self-correction he cuts himself off to ask Kay to report on her immediate action (line 26). This proposes that there is a sudden and urgent issue of Kay’s action, a more important issue even than correcting the prior mistake and the trouble of lag itself. However, Des’s report is non-specific and Kay responds with an answer that proposes ‘nothing of consequence’ (line 46). Des then complains about not wanting to see a specific part of Kay’s face (line 47). Kay hesitates (line 48) and then treats his complaint as confusing (line 49). Des finally indicates a problem with Kay’s image (line 50). By now the problem of lag has been completely dropped due to the need to correct Des’s mistake and then the problem of Kay moving out of her webcam’s field-of-view. Overarching both of these issues is the fact that the measured delay is noticeable but not practically disruptive to sequential interaction. Since no talk has been missed and conversation is continuing, there is little warrant for content or technological remedy.

#### *Treating trouble as an interactional opportunity*

Couples can enact the closeness of their relationship in the way they treat perturbations as troubling or not. This is especially obvious when a perturbation is treated as an affordance for teasing one’s intimate partner. This form of teasing works by treating an unexpected perturbation of the partner’s audio or video as showing them in an unflattering light. The joy of this is that one’s partner has no control or direct access to their perturbed transmission, providing the recipient with a brief moment of power by virtue of their unique perspective.

#### **Example 8.**

1. EVA: [I hope we can] fix the uh ((echo)) {ECHOED}  
 2. HAL: Ye\*a\*h  
 3. EVA: @Puts food in mouth@ Coz this is weird man  
 4. {ECHOED}  
 5. HAL: (Laughs) Especially when you talk and the  
 6. camera stops (1.5) It’s like @Rolls eyes up@  
 7. A Chinese movie. Suh- well[, an]+  
 8. EVA: [(Laughs)]  
 9. HAL: +English  
 10. movie with Chinese subtitles, wooo  
 11. EVA: (Laughs)  
 12. HAL: [/Dubbed kung-fu movie intonation/ You want  
 13. [↑food! ]  
 14. EVA: [(Laughs)]  
 15. HAL: (quiet laughter)  
 16. EVE: Y(h)ou(h)’r (h)e w(h)eird @Puts food in mouth@  
 17. HAL: Ah I’m hungry . stop eating in front of me  
 [Case055-p02-c01of05-t06p5641-13m45in-00m41s]

In Example 8, when responding to Eva’s assessment that the echo she is hearing on her end is “weird” (line 3), Hal provides a joking report of her desynchronized audio and video as being like a poorly dubbed film (line 6-13). He does not propose that there is any trouble understanding the content of Eva’s turns, nor does he propose any remedy. In Example 5 such a tease involved content-oriented remedy, but Example 8 shows that content need not be at issue and that the interactional opportunity of the tease may be treated as the most important part of the business at hand—even when one participant is actually experiencing a different kind of network trouble. Eva

laughs at Hal’s tease and teases him in response (line 16), but does not check on whether the desynchronisation has caused any content trouble, nor does she propose technological resolution. However, both members collaboratively buy into the perturbation as an opportunity to use technological mediation as a resource for their relational talk. Other forms of teasing are denied long-distance couples, so taking up perturbation as a resource is an obvious and easy adaptation, albeit not one that they would have intended or requested.

#### **CONCLUSIONS**

This paper has provided a brief overview of how couples cope with PV network trouble, finding managed through technology-oriented remedies, content-oriented remedies, and non-remedial accounts for trouble. All categories involve sequentially developed and collaborative orientations to how social and technological issues intersect in accounts for conversational continuity.

Whether connection, content, or neither was treated as perturbed, the couples focused their attention on the accountability of continuity, which was heavily dependent on whether sequential turns at talk were disrupted. Video perturbation, usually not as sequentially crucial, was thus often let pass. Although this is in line with prior findings, the most surprising extension here is that this connection/content/let-pass split is quite a strong separation. When participants oriented to the connection, whether or not they attempted remedy, they showed surprisingly little interest in recovering the perturbed content that led them to attempt technological remedy. When participants oriented to content, they could elide attribution to technology altogether, or if they did attribute the trouble to technology they could invoke a connection problem without following it up with an attempt at technological remedy. But participants could also find ways to account for why perturbation should be let pass or even used as a resource. It would seem that this split is not simply a matter of what is treated as communicatively important but a split in attention to the audio and video channels. Participants seemed to treat audio and video as parallel, not combined, communicative signals. PV, then, was treated more as ‘telephone with images’ than it was an analogue to co-present conversation. This harks back to some of the classic findings on modern videoconferencing about the apparently limited utility of adding video to audio (Chapanis et al., 1972).

These findings echo the turn towards the local accountability of technology in CT research (Dourish 2001). For example, technology adoption research makes strong claims that the more problems that are experienced by users the less likely they are to adopt a technology (Rogers, 2003). As intuitive as this claim seems, the adoption literature tends to treat ‘trouble’ as a self-evident category. These findings, however, show that perturbations are not necessarily treated as disruptive. The participants would surely have preferred not to experience trouble, but their ability to cope with it speaks to the need for categories such as ‘trouble’ to be very carefully applied by researchers and developers alike.

On a practical level, even when successful, technology remedies were confusing to accomplish and temporary, and when they failed users fell back on non-remedial responses. But users certainly can cope with minor signal perturbations. This implies that perhaps more effort could be put into developing installation wizards that interactively aid users configure transmission settings. Apple iChat's Connection Doctor does some of this but it is not interactive. Skype's call testing service tests audio, but not video. The problem, of course, is that video requires more bandwidth and is more dynamic than audio, so it is less predictable in practice than the Connection Doctor implies, and Skype's call testing service may lull users into a false sense of security. Improved interactive setups could go a long way to both preventing severe trouble and inoculating users against likely regular perturbations. Beyond setup, the biggest problem home users face with network trouble is having no idea of dynamic nature of their Internet connection. An ongoing indicator of connection quality would prevent users being surprised by trouble and in formulating accounts of possible trouble. Again, iChat and Skype have numeric call quality indicators but they are far from the easy graphical indicators available on, say, mobile telephones, that are frequently employed by users. While accuracy would be quite difficult to develop, a rough sense of likely network conditions could prevent much frustration.

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