VR in Workplace Meetings: Learning from Social VR in “The Wild”

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Abstract

Recent research on commercial and artistic social VR points to emerging forms of social augmentation that could have lessons for remote collaboration in the workplace. HCI has long demonstrated opportunities for supporting meetings through various forms of technological mediation. Likewise, research on VR has explored social augmentation as a form of perceptual manipulation. However, emerging design approaches and social practices in the social VR sector point to ways that XR could support new kinds of communication affordances in remote meeting contexts. We introduce the notion of creating ‘social affordances’, conceived of at the *interpersonal* level of analysis of the social experience itself, to shape workplace meeting social dynamics and engagement. We present examples from existing social VR, and outline a research agenda aimed at developing workplace-focused social affordances in VR. We conclude with a set of research questions that we aim to address with this work.

Keywords

Virtual reality, social VR, meetings, social affordances, social augmentation

Introduction

In the 21st century workplace, a great deal of social interaction occurs in meetings, however, research on meetings -- and in particular workplace meetings -- has long demonstrated the challenges involved in running meetings effectively [17,42,52,19,26,35,36,29]. Even prior to COVID-19, research identified the increasing role played by remote meeting technology and recognized virtual meetings as an important area of challenge and opportunity for organizations [1,40]. Human Computer Interaction (HCI) research has underscored the important role that social forms of distributed cognition can play in supporting new capacities of human coordination [20,45]. This research has also looked at workplace meetings as a site of intervention, and demonstrated the role that technological mediation can play in supporting

interpersonal communication among teams [6,7,11,12,27,28,37,38,39,43,53,54]. Face-to-face meetings have been demonstrated to be superior to screen-mediated meetings along certain dimensions of proxemics and interpersonal awareness [31]. However, technologically mediated meetings have been demonstrated to be more effective than face to face meetings in some cases [18,21]. Along these lines, Hollan and Stornetta have argued that electronic media are best positioned to support new kinds of communicative affordances rather than "imitation of the mechanisms of face-to-face [interaction]" [27].

Existing Social Augmentation Research

Existing work on technologically mediated social augmentation for meetings has explored a range of data visualization feedback mechanisms, including a wide range of research that uses visualization of sociometric data to improve social dynamics (for example, reducing interruptions and supporting verbal parity) [28,39,12,11,43,38,54,32]. Related work also includes anonymous voting feedback for meetings [6], agent-based meeting moderation systems [4,13,14,25,33,54], AI-driven social inference systems for meeting interactions [5,27,53], robotic meeting agents [54], and augmented or "smart" meeting environments [15,34,44].

The rise of XR (VR, augmented reality, and mixed reality) has brought with it a new set of interactional parameters to explore in shaping social experience [46,50,56,57]. Social VR, unlike traditional screen-based remote meetings, not only supports aspects of embodied awareness (e.g. a heightened experience of social presence [51]), but also enables new forms of social augmentation that exceed what is possible in face-to-face contexts. For example, Bailenson et al's concept of transformed social interaction (TSI) [2,3] decouples visual feedback from the actual physical behavior of participants' social VR contexts. TSI as a category covers a range of phenomena including the so-called "Proteus effect," achieved by altering one's avatar form to influence social behavior [57]. More recent work in this area includes research on social augmentation in VR. For example, Roth et al. uses hybrid avatar-agent systems to manipulate and augment non-verbal social cues in VR [46,47]. This work includes augmentations of hybrid social gaze [49] and using a similar approach to modulate eye contact, shared attention, and proximity among users participating in a virtual museum [48].

A Social Affordances Approach to Social Augmentation

While the VR research described above has successfully demonstrated that altering the perceptual experience of an individual in VR can profoundly influence social behavior, we present an alternative approach to shaping social interaction in VR. Existing studies tend to introduce disparities between a physical body's actual actions vs. a VR user's perception of social signalling—for example, a teacher who seems to be making eye contact with all students at once. By contrast, our approach emphasizes the transformative potential of social affordances [8,9,24], **perceived simultaneously by multiple participants**. Our own design research on this topic [41] illustrates how novel social affordances can unleash new collective human capacities. Examples include: wearables to support conversational balancing [10], social

affiliation [55], and connection [8], embodied signals in VR to support emotional communication, social affiliation, and shared navigation [30,41], and new geometries of attention for large group interactions

Gibson's concept of 'affordance' models perception in terms of action capacities of the physical world for an embodied subject. Social affordances represent an alternative ecological approach to social interaction [16] whereby the interactive features of bodies, artifacts, and environments all become potential resources for social mediation, in the sense of Hutchins' work on distributed cognition [22]. In the physical world, for example, we can conceive of the social affordances of whiteboards, projectors, microphones, name tags, sticky notes, and other props that can be passed from hand to hand. These sorts of mediating artifacts can transform the ways that humans can interact with one another and enable new kinds of social coordination to emerge. Accordingly, our approach to social augmentations for meetings in VR treats shared *social experience itself* as the site of design intervention (as opposed to intervening at the level of the individual perception). This is a perceptual shift that we believe can lead to fruitful reconception of technological support for interpersonal communication and connection [23]. Our approach to designing for meetings in VR, then, is to provide multiple participants with new embodied capacites, new social artifacts, and new environmental features in order to augment social signalling and unlock new social affordances in VR. This approach builds upon trends that we have seen in doing analysis of current social VR practice in commercial and artistic spaces, and we detail a slice of that research below.

Emerging Opportunities and Lessons from Social VR

Leveraging Metaphors Place and New Geometries of Space

Our research on social VR includes a study based on interviews of the creators of social VR applications including: Mozilla Hubs, High Fidelity, AltspaceVR, Rec Room, and AnyLand [30,41]. Our goal was to better understand how the creators of commercial social VR think about shaping social interaction in this quickly evolving sector. What design lessons have they incorporated and what sorts of values and approaches underlie their designs. One aspect that this research reinforced was the ways that the creators of commercial social VR applications utilize familiar metaphors of place to activate particular registers of social participation. In other cases, however, the affordances that they build into their environments go far beyond the familiar in order to support new kinds of social affordances not possible in physical space. This sort of departure from the known was particularly salient in contexts where creators had to design environments and feature-sets for large public gatherings where many participants needed to coordinate communication among each other. For example, the creators of both AltspaceVR and Rec Room participate in regular Q&A events or "town hall" gatherings as a way of communicating with and getting feedback from their users. The application creators and community coordinators developed innovative approaches to environmental design and communication affordances.

What follows is a brief but illustrative example about the evolution of Rec Room's Q&A environment [Fig. 1]. Rec Room developers and community managers stressed the importance of architectural layout in an auditorium room (with a stage for speakers and seats for audience members) that was designed for Q&A sessions between the player community and the Rec Room developers. Tamara Hughes a community support coordinator for Rec Room noted that earlier iterations of this space lacked seating and levels and that it was a "mad house because people would just [stand] at the front." As a result the development team added seating, to make it feel more like a theater space, which encouraged users to sit down and be quiet. They also enabled the couches to be teleport targets which would position your avatar in a seated position. And finally they added privileged roles for speakers on the stage vs. in the audience. Those in the audience however can speak audibly if they were handed a microphone.

Figure 1: In Rec Room's Q&A, audience members can teleport into seated-position on couches (lower image) but are not able to teleport onto the stage unless invited (upper right). A giant cat stares at a microphone which can be handed off to an audience member (upper left).

As an aside, note how the design choices described so far are modeled on existing social expectations of an auditorium and social ritual of audience participation in order to support and prime expectations about appropriate behavior in a Q&A. Also note that the specific affordances Rec Room created parallel these expectations (only certain people can get on stage and only participants with mic can talk), so the designers have also restricted participation to practices which conform to those expectations.

However -- here is where things get interesting -- the creators found that it was difficult for participants to spot who in the audience was currently speaking into the mic (since signals of spatialized audio and body language are not as clear as they might be in physical space). To address this problem, the creators came up with a rather ingenious solution. They designed a giant cat non-player-character (NPC) to sit on the stage to the side of the speakers and look at wherever the mic was at any given time [Fig. 2]. With giant pupils visible to those in the audience, this NPC stares in the direction of the microphone wielding participant, so other attendees can track who is speaking at a given time. The introduction of this element into an

otherwise familiar context opened up new capacities of attentional coordination and new geometries of attention among the Q&A participants.

Figure 2: In Rec Room's Q&A, this giant cat (NPC) sits on the stage and locks eyes with whomever currently has a microphone, so that audience members can track who is speaking at a given time.

This example is illustrative of a common pattern we see playing out in the social VR sector—creators begin with familiar scaffolding but then introduce new social affordances that begin to augment and stretch our expectations about space, communication, and social interaction. We hypothesize similar processes of discovery could uncover new social affordances in workplace VR meetings that expand our understanding of communication beyond what is possible in physical space.

Embodied Signalling to Support Trust and Connection

Our research on social VR suggests that embodied forms of emotional signalling and affinity signalling point to rich opportunities for trust and connection [39], [40]. Emojis in VR offer an alternative channel for users to communicate affect, especially in group situations when attention may be split between a speaker or performer and an emoting audience. Figure 3 depicts emoji signalling in AltspaceVR, one of the software applications we examined in this work. These signals emanate from a user's body and float upwards. During a highly touted first live concert by Reggie Watts in AltspaceVR, audiences utilized this emoji system as a way of communicating collective ambient feedback en masse (for example, as a form of visual applause).

In Rec Room, Figure 4, the 'Expresso' emoting system represents a different emoji mechanic that enables users to quickly gesture to select a facial expression, which then appears as a bubble above their avatar's head.

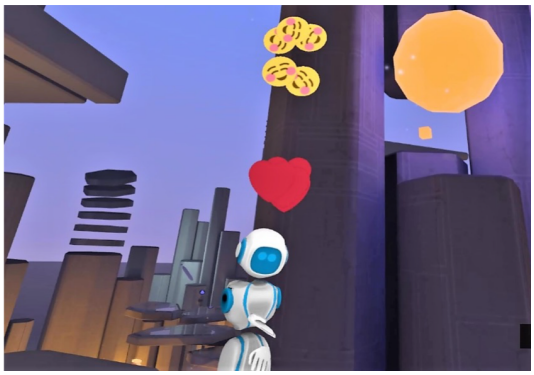

Figure 3. Emoji signalling system in AltspaceVR.

Figure 4. 'Expresso' emoting system and team bands in Rec Room.

In addition, in Rec Room users not only signal emotions, but also team affinity, as a way of managing how groups navigate. The colored watch bands in Figure 4 let team members know that they can travel to a new world together as a unit, and they also signal a shared identity within a team.

We hypothesize that similar opportunities to communicate affect and affinity could be utilized in workplace meetings in VR. That said, despite the introduction of emotion and affinity signals in a variety of VR platforms, significant design questions remain regarding the best way to support communication goals of groups. Are traditional 2D emoticons that float upwards and then disappear indeed the best way for collections of users to communicate affect? Should shared affinity signals be enduring cues that determine fundamental affordances like navigation, or could they also serve as ephemeral signals of affinity towards others that ebb and flow with context?

Reflections and New Questions

Emergent commercial and artistic social VR practices are pointing the way toward new forms of social augmentation to support meetings, which take unique advantage of the media properties of these shared immersive spaces. Designers and developers are innovating new strategies for supporting mutual attention, connection, collaboration, and trust building, that we can learn from in designing workplace-focused tools and platforms. It is our belief that social augmentation, and in particular, social affordances as we have defined them here, represent a powerful potential future for workplace support of meetings. We envision situations in which workers may sometimes *prefer* to meet in social VR because they appreciate the embedded social affordances that modulate team dynamics and mood, helping to build trust and cohesion, and shifting social processes for mutual benefit. We are presently engaged in a research-through-design process to build exemplars of such social affordances, testing them against meeting spaces without such affordances. Here are some of the questions that are guiding this work:

- Which sorts of social affordances are most beneficial and how do they operate?
- Who shall author and modulate these affordances, and how might this support (rather than hinder) team meeting process? This encompasses ethical considerations that inevitably arise when social contexts are consciously shaped.
- Which social affordances might take special advantage of the media qualities of VR? How might these differ from affordances that best take advantage of AR, or wearables-based support of in-person meetings? And how then can this way of thinking help shape design of a range of technologically mediated meeting contexts?

We hope this position paper will provide interesting food for thought for others engaged in shaping future workplace tools and platforms to support meetings, and social interaction in general.

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References

1. Brooke B. Allison, Marissa L. Shuffler, and Allison M. Wallace. 2015. The Successful Facilitation of Virtual Team Meetings. In J.A. Allen, N. Lehmann-Willenbrock, and S.G. Rogelberg, eds., *The Cambridge Handbook of Meeting Science*. Cambridge University Press, Cambridge, 680–706.
2. Jeremy N. Bailenson, Andrew C. Beall, Jack Loomis, Jim Blascovich, and Matthew Turk. 2004. Transformed Social Interaction: Decoupling Representation from Behavior and Form in Collaborative Virtual Environments. *Presence: Teleoperators and Virtual Environments* 13, 4: 428–441.
3. Jeremy Bailenson, Nick Yee, Jim Blascovich, and Guadagno Rosanna E. 2008. Transformed social interaction in mediated interpersonal communication. In *Mediated interpersonal communication*. Routledge, New York.
4. P. Barthelmess and C. A. Ellis. 2002. The Neem Platform: An Extensible Framework for the Development of Perceptual Collaborative Applications. In Y. Han, S. Tai, and D. Wikarski, eds., *Engineering and Deployment of Cooperative Information Systems*. Springer Berlin Heidelberg, Berlin, Heidelberg, 547–562.
5. P. Barthelmess and C. A. Ellis. 2002. The Neem Platform: An Extensible Framework for the Development of Perceptual Collaborative Applications. In Y. Han, S. Tai, and D. Wikarski, eds., *Engineering and Deployment of Cooperative Information Systems*. Springer Berlin Heidelberg, Berlin, Heidelberg, 547–562.
6. Tony Bergstrom and Karrie Karahalios. 2007. Conversation votes: enabling anonymous cues. *CHI '07 extended abstracts on Human factors in computing systems - CHI '07*, ACM Press, 2279.
7. Tony Bergstrom and Karrie Karahalios. 2012. Distorting Social Feedback in Visualizations of

Conversation. *2012 45th Hawaii International Conference on System Sciences*, IEEE, 533–542.
8. Ella Dagan, Elena Márquez Segura, Ferran Altarriba Bertran, Miguel Flores, and Katherine Isbister. 2019. Designing 'True Colors': A Social Wearable that Affords Vulnerability. *Proceedings of CHI 2019*, ACM.
9. Ella Dagan, Elena Márquez Segura, Miguel Flores, and Katherine Isbister. 2018. "Not Too Much, Not Too Little" Wearables For Group Discussions. *Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems - CHI '18*, ACM Press, 1–6.
10. Ella Dagan, Elena Márquez Segura, Miguel Flores, and Katherine Isbister. 2018. "Not Too Much, Not Too Little" Wearables For Group Discussions. *Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems*, ACM, LBW129:1–LBW129:6.
11. Joan Morris DiMicco, Katherine J. Hollenbach, Anna Pandolfo, and Walter Bender. 2007. The Impact of Increased Awareness While Face-to-Face. *Human–Computer Interaction* 22, 1–2: 47–96.
12. Joan Morris DiMicco, Anna Pandolfo, and Walter Bender. 2004. Influencing group participation with a shared display. *Proceedings of the 2004 ACM conference on Computer supported cooperative work - CSCW '04*, ACM Press, 614.
13. Clarence (Skip) Ellis and Paulo Barthelmess. 2003. The neem dream. *Proceedings of the 2003 conference on Diversity in computing - TAPIA '03*, ACM Press, 23–29.
14. Clarence Ellis, Jacques Wainer, and Paulo Barthelmess. 2003. Agent-Augmented Meetings. In Y. Ye and E. Churchill, eds., *Agent Supported Cooperative Work*. Springer US, Boston, MA, 27–52.
15. Carlos Filipe Freitas, António Meireles, Lino Figueiredo, Joao Barroso, Antonio Silva, and Carlos Ramos. 2015. Context aware middleware in ambient intelligent environments. *International Journal of Computational Science and Engineering* 10, 4: 347.
16. William W. Gaver. 1996. Situating Action II: Affordances for Interaction: The Social Is Material for Design. *Ecological Psychology* 8, 2: 111–129.
17. Jennifer L. Geimer, Desmond J. Leach, Justin A. DeSimone, Steven G. Rogelberg, and Peter B. Warr. 2015. Meetings at work: Perceived effectiveness and recommended improvements. *Journal of Business Research* 68, 9: 2015–2026.
18. Stefan Gudjohnsen. 2014. Virtual Teams and Virtual Meetings: Investigating the Conventional Wisdom that Face-to-Face Communication Is Better. .
19. J.Richard Hackman and Charles G. Morris. 1975. Group Tasks, Group Interaction Process, and Group Performance Effectiveness: A Review and Proposed Integration. In *Advances in Experimental Social Psychology*. Elsevier, 45–99.
20. James Hollan, Edwin Hutchins, and David Kirsh. 2000. Distributed Cognition: Toward a New Foundation for Human-computer Interaction Research. *ACM Trans. Comput.-Hum. Interact.* 7, 2: 174–196.
21. Jim Hollan and Scott Stornetta. 1992. Beyond Being There. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ACM, 119–125.
22. Edwin Hutchins. 1995. *Cognition in the wild*. MIT Press, Cambridge, Mass.
23. Katherine Isbister. 2019. Toward 'Suprahuman' Technology. *Proceedings of the Halfway to the Future Symposium 2019*, ACM, 1–4.
24. Katherine Isbister, Elena Márquez Segura, and Edward F. Melcer. 2018. Social Affordances at Play: Game Design Toward Socio-Technical Innovation. *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems - CHI '18*, ACM Press, 1–10.
25. Katherine Isbister, Hideyuki Nakanishi, Toru Ishida, and Cliff Nass. 2000. Helper agent: designing an assistant for human-human interaction in a virtual meeting space. *Proceedings*

of the SIGCHI conference on Human factors in computing systems - CHI '00, ACM Press, 57–64.
26. Simone Kauffeld and Nale Lehmann-Willenbrock. 2012. Meetings Matter: Effects of Team Meetings on Team and Organizational Success. *Small Group Research* 43, 2: 130–158.
27. Joseph Kim and Julie A. Shah. 2016. Improving Team's Consistency of Understanding in Meetings. *IEEE Transactions on Human-Machine Systems* 46, 5: 625–637.
28. Taemie Kim, Agnes Chang, Lindsey Holland, and Alex (Sandy) Pentland. 2008. Meeting mediator: enhancing group collaboration with sociometric feedback. *Proceeding of the twenty-sixth annual CHI conference extended abstracts on Human factors in computing systems - CHI '08*, ACM Press, 3183.
29. David J. Kocsis, Gert-Jan De Vreede, and Robert O. Briggs. 2015. Designing and Executing Effective Meetings with Codified Best Facilitation Practices. In J.A. Allen, N. Lehmann-Willenbrock, and S.G. Rogelberg, eds., *The Cambridge Handbook of Meeting Science*. Cambridge University Press, Cambridge, 483–503.
30. Anya Kolesnichenko, Joshua McVeigh-Schultz, and Katherine Isbister. 2019. Understanding Emerging Design Practices for Avatar Systems in the Commercial Social VR Ecology. *Proceedings of the 2019 on Designing Interactive Systems Conference - DIS '19*, ACM Press, 241–252.
31. Robert E. Kraut, Susan R. Fussell, Susan E. Brennan, and Jane Siegel. 2002. Understanding effects of proximity on collaboration: Implications for technologies to support remote collaborative work. In *Distributed work*. MIT Press, Cambridge, MA, US, 137–162.
32. Olga Kulyk, Jimmy Wang, and Jacques Terken. 2006. Real-Time Feedback on Nonverbal Behaviour to Enhance Social Dynamics in Small Group Meetings. In S. Renals and S. Bengio, eds., *Machine Learning for Multimodal Interaction*. Springer Berlin Heidelberg, Berlin, Heidelberg, 150–161.
33. Johan Kuperus. 2006. The effect of agents on meetings. *4th Twente Student Conference on IT*, University of Twente, 8.
34. Saadi Lahlou, ed. 2009. Experimental reality: principles for the design of augmented environments. In *Designing user friendly augmented work environments: from meeting rooms to digital collaborative spaces*. Springer, London.
35. N Lehmann-Willenbrock and S Kauffeld. 2010. The Downside Of Communication: Complaining Circles In Group Discussions. In S. Schuman, ed., *The handbook for working with difficult groups: how they are difficult, why they are difficult and what you can do about it*. Jossey-Bass, San Francisco, CA, 33–54.
36. Nale Lehmann-Willenbrock, Joseph A. Allen, and Simone Kauffeld. 2013. A Sequential Analysis of Procedural Meeting Communication: How Teams Facilitate Their Meetings. *Journal of Applied Communication Research* 41, 4: 365–388.
37. Gilly Leshed, Dan Cosley, Jeffrey T. Hancock, and Geri Gay. 2010. Visualizing language use in team conversations: designing through theory, experiments, and iterations. *Proceedings of the 28th of the international conference extended abstracts on Human factors in computing systems - CHI EA '10*, ACM Press, 4567.
38. Gilly Leshed, Jeffrey T. Hancock, Dan Cosley, Poppy L. McLeod, and Geri Gay. 2007. Feedback for guiding reflection on teamwork practices. *Proceedings of the 2007 international ACM conference on Conference on supporting group work - GROUP '07*, ACM Press, 217.
39. Gilly Leshed, Diego Perez, Jeffrey T. Hancock, et al. 2009. Visualizing real-time language-based feedback on teamwork behavior in computer-mediated groups. *Proceedings of the 27th international conference on Human factors in computing systems -*

CHI 09, ACM Press, 537.
40. Peter Abrahamsson Lindeblad, Yuliya Voytenko, Oksana Mont, and Peter Arnfalk. 2016. Organisational effects of virtual meetings. *Journal of Cleaner Production* 123: 113–123.
41. Joshua McVeigh-Schultz, Anya Kolesnichenko, and Katherine Isbister. 2019. Shaping Pro-Social Interaction in VR: An Emerging Design Framework. *2019 CHI Conference on Human Factors in Computing Systems Proceedings*, ACM Press.
42. Joseph E. Mroz, Joseph A. Allen, Dana C. Verhoeven, and Marissa L. Shuffler. 2018. Do We Really Need Another Meeting? The Science of Workplace Meetings. *Current Directions in Psychological Science* 27, 6: 484–491.
43. Alex “Sandy” Pentland, Pamela Hinds, and Taemie Kim. 2012. Awareness as an antidote to distance: making distributed groups cooperative and consistent. *Proceedings of the ACM 2012 conference on Computer Supported Cooperative Work - CSCW ’12*, ACM Press, 1237.
44. Rutger Rienks. 2007. Meetings in Smart Environments Implications of Progressing Technologies. .
45. Yvonne Rogers and Judi Ellis. 1994. Distributed cognition: an alternative framework for analysing and explaining collaborative working. *Journal of Information Technology* 9, 2: 119–128.
46. Daniel Roth, Gary Bente, Peter Kullman, et al. 2019. Technologies for Social Augmentations in User-Embodied Virtual Reality. *VRST*.
47. Daniel Roth, Constantin Klelnbeck, Tobias Feigl, Christopher Mutschler, and Marc Erich Latoschik. 2018. Beyond Replication: Augmenting Social Behaviors in Multi-User Virtual Realities. *2018 IEEE Conference on Virtual Reality and 3D User Interfaces (VR)*, IEEE, 215–222.
48. Daniel Roth, Constantin Klelnbeck, Tobias Feigl, Christopher Mutschler, and Marc Erich Latoschik. 2018. Beyond Replication: Augmenting Social Behaviors in Multi-User Virtual Realities. *2018 IEEE Conference on Virtual Reality and 3D User Interfaces (VR)*, IEEE, 215–222.
49. Daniel Roth, Peter Kullmann, Gary Bente, Dominik Gall, and Marc Erich Latoschik. 2018. Effects of Hybrid and Synthetic Social Gaze in Avatar-Mediated Interactions. *2018 IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct)*, IEEE, 103–108.
50. Mel Slater, Bernhard Spanlang, Maria V. Sanchez-Vives, and Olaf Blanke. 2010. First Person Experience of Body Transfer in Virtual Reality. *PLoS ONE* 5, 5: e10564.
51. Harrison Jesse Smith and Michael Neff. 2018. Communication Behavior in Embodied Virtual Reality. *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems - CHI ’18*, ACM Press, 1–12.
52. Ivan Dale Steiner. 1972. *Group process and productivity*. Academic Press, New York.
53. Yla R. Tausczik and James W. Pennebaker. 2013. Improving teamwork using real-time language feedback. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems - CHI ’13*, ACM Press, 459.
54. Hamish Tennent and Malte Jung. 2019. Micbot: A Peripheral Robotic Object to Shape Conversational Dynamics and Team Performance. *2019 ACM/IEEE International Conference on Human-Robot Interaction*.
55. Loïs Vanhée, Elena Márquez Segura, and Katherine Isbister. 2018. Firefly: A Social Wearable to Support Physical Connection of Larpers. *Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems*, ACM, D311:1–D311:4.
56. Andrea Stevenson Won, Jeremy Bailenson, Jimmy Lee, and Jaron Lanier. 2015.

Homuncular Flexibility in Virtual Reality. *Journal of Computer-Mediated Communication* 20, 3: 241–259.
57. Nick Yee and Jeremy Bailenson. 2007. The Proteus Effect: The Effect of Transformed Self-Representation on Behavior. *Human Communication Research* 33, 3: 271–290.