

This Is Your Brain on Zoom

Analysis by [Dr. Joseph Mercola](#)

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STORY AT-A-GLANCE

- › Conversing in-person results in strong and complex neural signaling, but this is dramatically reduced when meetings take place virtually, with unknown consequences for the human psyche
- › A Yale team used neuroimaging technologies to study interactions between two people in real time, face-to-face as well as conversations on the video conferencing platform Zoom
- › Significant differences were found in brain activity, with the strength of neural signaling reduced on Zoom compared to in-person
- › Those speaking face-to-face had increased gaze time and increased pupil diameters, which suggests increased arousal in the brain
- › The participants' brains also had coordinated neural activity in-person, likely due to reciprocal exchanges of social cues that the pair experienced during their face-to-face chat

The use of online video conferencing skyrocketed during the COVID-19 pandemic, likely changing the course of business meetings permanently. But the convenience of online meetings may come at a cost, according to scientists with Yale School of Medicine.¹

While you may be able to share the same information in-person or virtually, your brain isn't fooled – and its activity differs significantly during the two meeting formats. Conversing in-person results in strong and complex neural signaling, but this is

dramatically reduced when meetings take place virtually, with unknown consequences for the human psyche.

Brain Activity Suppressed During Zoom Calls

In December 2019, Zoom had 10 million meeting participants daily. This jumped to more than 300 million by April 2020. This surge in online meetings isn't likely to decline but, rather, represents a likely long-term shift. By one estimate, by 2024 only 25% of business meetings will be conducted in-person.²

But if you're interested in deep, meaningful communication, in-person may be preferable to online. The Yale team used neuroimaging technologies to study interactions between two people in real time. Neural system responses were recorded for live interactions as well as conversations on the video conferencing platform Zoom.

Significant differences were found in brain activity, with the strength of neural signaling reduced on Zoom compared to in-person. Those speaking face-to-face had increased gaze time and increased pupil diameters, which suggests increased arousal in the brain.

Increased EEG activity also occurred, which is indicative of enhanced face processing ability. Your brain is designed to process dynamic facial cues during conversations with other people,³ but much of this may be lost when chatting over a screen.

The participants' brains also had coordinated neural activity, likely due to reciprocal exchanges of social cues that the pair experienced during their in-person chat. In contrast, neural signaling during Zoom conversations was "substantially suppressed." Senior study author Yale neuroscientist Joy Hirsch explained:⁴

"In this study we find that the social systems of the human brain are more active during real live in-person encounters than on Zoom ... Zoom appears to be an impoverished social communication system relative to in-person conditions.

... Overall, the dynamic and natural social interactions that occur spontaneously during in-person interactions appear to be less apparent or absent during Zoom encounters. This is a really robust effect ... Online representations of faces, at least with current technology, do not have the same 'privileged access' to social neural circuitry in the brain that is typical of the real thing."

Psychological Consequences of Virtual Meetings

Widespread use of video conferences is a new phenomenon that's only beginning to be explored from a psychological perspective. While its long-term effects on well-being and mental health are unknown, so-called "Zoom fatigue" or "virtual meeting fatigue" has already emerged.

This describes the exhaustion that many people experience when they've attended long periods of virtual meetings. It's likely caused by a number of factors that are unique to the online world, including:⁵

Increased cognitive load due to prolonged gaze from others

The apparent closeness of others

Reduced mobility

Unmet expectations regarding synchrony and nonverbal cues

Loss of a sense of place

Lessened scaffolding and supervision

Reduced dynamic and nonconscious distribution of work among teammates

Virtual meeting fatigue has a negative effect on worker well-being and productivity, life satisfaction and academic well-being, and is associated with anxiety, depression and stress.⁶ Part of the problem believed to contribute to Zoom fatigue is eccentric gaze.

“Common videoconferencing hardware setups necessitate that if a user looks at the image of the person with whom they are in videoconference, they will not be looking directly at the camera and will appear to not be making direct eye contact,” notes a study in the *Journal of Binocular Vision and Ocular Motility*.⁷

Another reason for the negative effects could be mirror anxiety, or negative self-focused attention, which can occur as you look at yourself during the video call. Mirror anxiety is psychologically stressful and contributes to virtual meeting (VM) fatigue, which is more common among women than men, as well as Asian participants than White participants.

“VM fatigue is caused at least, in part, by the harmful psychological load (i.e., negative self-focused attention) induced through viewing of self-video,” according to a study published in *Cyberpsychology, Behavior and Social Networking*.⁸

While you could simply turn off your camera, this presents additional concerns, such as lack of awareness about self-presentation or unintentionally broadcasting embarrassing background activity, the team pointed out.

Using filters to slightly modify your appearance is another option, but this, too, could backfire by resulting in adverse changes to cultural beauty standards. Fully digital avatars may be a viable option that allows people to self-monitor while on a video call and interact using verbal and nonverbal cues, without causing negative self-focused attention.⁹

Creativity, Idea Generation Also Suffer During Video Calls

There appear to be a number of cognitive costs that come with communicating through screens instead of in-person. There’s something about sharing a physical space that adds to the generation of creative ideas, for instance, but that “something” is lost when collaborating through a screen, according to researchers from Columbia and Stanford Universities.¹⁰

They conducted a study involving 602 people, in which participants were randomly paired to generate creative uses for a product over a five-minute period, then instructed

to select their most creative idea for one minute more. Pairs worked together in person or virtually, with the virtual participants using a video display of their partner.

Significant differences were noted, including that virtual pairs generated significantly fewer total ideas compared to in-person pairs. In the second part of the experiment, 151 pairs generated creative uses for a product either in person or virtually, but this time the setting was a room with 10 props, some ordinary, like folders, and some unusual, such as a skeleton poster.

This phase of the study involved asking the participants to recall the props in the room, while the researchers also recorded participants' eye gaze. The idea was to test their hypothesis that "virtual communication hampers idea generation because the bounded virtual space shared by pairs narrows visual scope, which in turn narrows cognitive scope."¹¹

As suspected, the virtual pairs spent significantly more time focused on the screen looking directly at their partners and significantly less time looking around the room. As such, they were able to recall significantly fewer unusual props in their room compared to in-person pairs. Further, both unusual prop recall and gaze around the room were significantly associated with an increase in the number of creative ideas.¹²

"This combination of analyses converges on the view that virtual communication narrows visual focus, which subsequently hampers idea generation," according to the study.¹³

They then took it a step further to determine whether the results would hold true in a typical workplace, as opposed to a laboratory setting. For the field experiment, 1,490 engineers worked in pairs either face-to-face or via videoconference to generate product ideas for one hour, then select one of them to submit as a product innovation for the company.

Similar to the laboratory study, the engineers working virtually generated fewer total ideas and fewer creative ideas than those working together in-person. There was, however, some indication that when it comes to selecting an idea, virtual

communication may be equivalent to, or perhaps even more effective, than in-person collaboration.

Zoom Calls Lead to a Warped Sense of Space

Another theory suggests virtual meetings lead to fatigue as part of a larger “computer-mediated communication (CMC) exhaustion.” The fact is that communicating via a screen is not equivalent to the way humans have evolved to interact in real-life settings.

Part of that has to do with spatial differences that occur, according to Robby Nadler, director of UC Santa Barbara’s Academic, Professional and Technical Graduate Writing Development Program.¹⁴ He refers specifically to virtual communications leading to the creation of “third skins”:¹⁵

“[T]hird skins are proposed to account for how nuanced differences in space between SOCs [synchronous online consultations] and face-to-face exchanges mean participants are not engaged as human actors but “flattened” into a totality of third skin comprising person, background, and technology.

The resulting transformation and our bodies exerting substantial cognitive efforts to interact with this transformation are theorized to produce CMC exhaustion.”

Your first skin is the skin on your body – which people around you can use to assess your age, gender and race. Your second skin is your clothing, another layer of identify that others take in when they see you. The space around you – your home or a coffee shop you’re in while having a conversation – is not part of you. Rather it’s the space you’re in. But during a virtual meeting, that space becomes your third skin – a part that becomes indistinguishable from you as a person.¹⁶

Nadler used the example of chatting in a coffee shop, in which a coffee grinder makes noise in the background. All parties in your in-person meeting associate the coffee grinder with typical background noise in the shop. In a virtual setting, however, the coffee grinder in the background would be a disruption associated with you.¹⁷

Fundamental changes such as this, together with now-demonstrated changes in brain activity, show that conversing virtually may be having complex – and as yet unappreciated – effects on human social interactions.

Your Vision Is Also at Risk

The increase in virtual communication may also be jeopardizing your eyesight – and that of future generations. The prevalence of myopia, or nearsightedness, has increased in recent decades, especially in East Asia, and the numbers are expected to get worse in the next 50 years.

In 2019, the American Academy of Ophthalmology (AAO) established the Task Force on Myopia to address the “substantial global increases in myopia prevalence and its associated complications.”¹⁸

It's believed that technology – particularly staring at screens all day – is one culprit in the rise, leading to problems with vision at younger and younger ages, which could lead to “an epidemic of blindness that's decades down the road,” according to Michael Repka, an ophthalmology professor at Johns Hopkins University.¹⁹

Increased screen time and near work, with limited time outdoors, are associated with myopia.²⁰ So, if you want to combat some of the pitfalls of virtual communication, spend more time away from screens, outdoors. “Long ago, humans were hunters and gatherers,” Dr. Liandra Jung, an optometrist in the Bay Area, told The Atlantic. “We relied on our sharp distance vision to track prey and find ripe fruit. Now our modern lives are close-up and indoors.”²¹

Meanwhile, take time to communicate face-to-face as much as possible. For times when virtual meetings are unavoidable, it may be difficult to counter the reduced brain activity or altered sense of space that occurs via screen-based communication. However, you can take steps to minimize fatigue as much as possible, including:²²

- Turn on your camera only when necessary (to reduce mirror anxiety)

- Take breaks between meetings
- Use a standing desk to encourage physical movement

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