



# “I want more than 👍” User-generated Icons for Better Video-mediated Communications on the Collaborative Design Process

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(a) Current ZOOM icon for “Good” reaction

(b) User-generated icons for “Good” reaction

**Figure 1: Comparison usages of current ZOOM’s icon system and user-generated icons.**

## ABSTRACT

The COVID-19 pandemic has led to the proliferation of non-face-to-face video-mediated communication such as through ZOOM or Google Meet. However, video-mediated communication has several limitations related to exchanging vocal reactions and non-verbal expressions. Consequently, although current video conferencing platforms provide visual support through icons, it remains challenging for users to express various intentions because of the limited number of icons, their uniform size, and their fixed location. In particular, these limitations challenge designers who require collaborative design processes such as brainstorming. To investigate user needs related to icons that better support video-mediated communication, we conducted a participatory design methodology. Based on the analyses of participants’ brainstorming experiences with various icons through participatory paper prototyping, we found that icons that accurately reflect diverse user needs facilitated turn-taking during the design process, and allowed participants

to exchange more opinions and emotions. Thus, they created a positive atmosphere in the online meeting environment.

## CCS CONCEPTS

• **Human-centered computing** → **User centered design.**

## KEYWORDS

Video-mediated communication, Participatory design, Paper prototype, Icon design

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## 1 INTRODUCTION

Due to the COVID-19 pandemic, non-face-to-face communications, meetings, and collaborations have become increasingly prevalent. Accordingly, the use of video conferencing platforms such as ZOOM [4] and Google Meet [5] has increased. However, in such an online environment, users have difficulty grasping non-verbal expressions, such as facial expressions and gestures, due to screen size limitations [8]. In addition, due to high dependence on sound in video-mediated communication, even a small noise can hinder communication. This prevents users from employing various vocal

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**Table 1: Comparison between communication in online and offline environments**

	Offline environment	Online environment (video conferencing platform)
Modality	Flexibly use various modalities such as gesture and motion	Mostly auditory with the aid of visual
Latency in turn-taking	Trivial (in milliseconds)	Relatively long, depends on technical issues
View of others	Unlimited	Limited in small screens, mostly up to shoulder
Delivery of nonverbal expressions	Well delivered	Limited, depends on screen size and resolution
Interactiveness of communication	Unlimited	One-sided, with only one audio output channel
Limitation of time and space	O (participants should be in the same place at the same time)	X (participants can communicate remotely)

reactions or non-verbal expressions that are often used in face-to-face communication.

To address these difficulties related to online communication, several studies have attempted to apply visual elements and icons in voice-mediated and computer-mediated communication (CMC) to provide better user experiences [6–8, 16]. For instance, visual elements such as icons can better convey correct emotion, attitude, and attention intent in CMC [3, 7]. The importance of icons, which has already been emphasized in previous studies, is attracting more attention than ever in the pandemic situation in which non-face-to-face communication has become mainstream. Moreover, Kohnke and Moorehouse found that ZOOM’s icons play a significant role in increasing students’ communication efficiency in a video-mediated online learning environment [6]. As a result, these studies provide valuable insights into the extent to which visual aids in the online environment increase the effectiveness of communication by supporting non-verbal expressions and reactions.

Based on the advantages of icons for supporting communications, current video conferencing platforms such as ZOOM and Google Meet also provide emojis or reaction functions to support non-verbal expression in video communication [4, 5]. However, the currently available icons are limited; this prevents users from expressing various states and actions (Figure 1). Furthermore, because the icons’ shape, size, and location are static, they do not always adequately reflect the users’ intentions, which changes dynamically depending on the situation [2].

Due to these limitations, designers in particular face challenges in video communication. As the active exchange of opinions and reactions is crucial in the design process such as brainstorming [10], the decrease in non-verbal expressions makes turn-taking difficult and hinders the exchange of ideas. In this regard, such difficulties can become barriers to the development of various design ideas and directions. In fact, in our preliminary study, we found that designers are experiencing more difficulty with communication itself than with the process of collaborative design work. In addition, they rarely use the icons provided by ZOOM. Therefore, a new icon system that can reflect users’ deeper needs is necessary to enhance the effectiveness and utility of icons for video communication.

In our study, through a user-centered participatory design method [1, 9], we explored a design direction to improve the icon system provided by current video conferencing platforms and provide a better user experience. We explored the difficulties of communication

in the current online design environment and the potential of icons through a preliminary study. Based on these findings, in our main study, we provided a toolkit for designing icons for participants, asked them to design icons freely, and went through iteration sessions using rapid paper prototyping [13, 14]. Participants used the designed icons they wanted to use during the actual brainstorming process and evaluated the icons’ effectiveness in terms of brainstorming through focus group interviews (FGIs) [11]. By analyzing the data, we were able to classify functions of icons into six categories and further reveal each category’s features and effects. As a result, we found user-driven icon designs facilitated turn-taking during the design process and allowed participants to exchange more opinions and emotions.

## 2 PRELIMINARY STUDY

In our preliminary study, we conducted a survey and interview to understand the user needs in online design environments by comparing design experiences of online and offline brainstorming.

### 2.1 Participants

To explore the advantages and disadvantages of online and offline brainstorming specifically, we recruited 7 designers who have sufficient experience with cooperative design in both environments (*age avg*: 24.43, *std*: 3.05).

### 2.2 Procedure

The preliminary study consisted of two parts. In the first part, participants completed a survey, describing the design tools and methods they use online and offline, as well as the advantages and disadvantages they perceive for each environment. In addition, participants were asked to evaluate their design experiences in each environment quantitatively, particularly regarding the amount of ideation, time spent, and their satisfaction and engagement. In the second part, we conducted interviews based on the survey results. We asked the participants to bring design results from online and offline meetings, and to share specific episodes for comparing each experience.

### 2.3 Result

We organized the results of our survey and interview as shown in Table 1. Participants pointed out discomfort in three areas of communication. First, they experienced difficulties taking turns.



Figure 2: Paper prototyping toolkit for designing icon and study settings.

Second, they felt hesitant to respond verbally. Third, the screens of video conferencing platforms were too small to access the states and actions of other participants. Most of these discomforts could be eased with icons such as “👏” or “👉,” which are currently provided by ZOOM; however, these icons were too limited in number to cover all the diverse non-verbal expressions that can be used offline, and they did not fulfill user needs sufficiently.

### 3 MAIN STUDY

Based on the results of preliminary study, we planned our main study to identify a better direction for the current icon system in terms of reflecting user needs. We chose to conduct a participatory design [1] to best understand and reflect the user needs.

We adopted the paper prototyping method [13, 14] to maximize the participants’ freedom and encourage rapid iteration. Through this user-generative approach, we intended to allow participants to create icons that reflect their needs instantaneously, and broaden the possible range of icons. This included not only the icons’ size and shape, but also their locations on the screen. Therefore, we provided a toolkit (Figure 2 (a)) along with a standing acrylic board. The toolkit consisted of materials participants needed to design icons. Specifically, it included materials such as icon stickers that participants can refer to as examples, various adhesive notes and papers, colored pens and pencils, scissors, and glue, so participants could freely draw or cut out new icons. Board markers were also provided so the participants could draw on the acrylic board if necessary.

For the study setting, we placed an acrylic board in front of each participant’s laptops (Figure 2 (b)). Due to the boards’ transparency, the participants could freely attach icons to desired locations without hindering their sight. In addition, participants could use the acrylic board as a white board and freely annotate whatever they want (Figure 2 (c)). By integrating paper prototyping with the use of acrylic boards, we expected the participants to be able to create desired types of icons in the desired size and shape, and to attach them to desired locations.

#### 3.1 Participants

To observe how icons are used in real online communications, we recruited 7 participants in 2 groups (*age avg*: 27.83, *std*: 2.26). All participants were experts in design with 3-8 years of field experience, and they were familiar with online design cooperation. Group 1 consisted of 3 participants whereas Group 2 consisted of 4 participants. For smooth and effective communication, we recruited

participants who already knew each other and had collaborative design experiences.

#### 3.2 Procedure

Each of two groups participated in the experiment in the form of non-face-to-face meetings. ZOOM was used for video communication because this platform was the most familiar to all participants. First, after delivering the toolkit to each participant, we introduced its contents, as well as the outline of the experiment. Next, participants were allowed to be inspired by example icon stickers in the toolkit and design new icons by themselves.

After that, the participants held a video meeting to introduce the icons they had created to the group and share their meanings with each other. During an iteration session, they modified their icon designs based on the preceding conversation. The paper prototyping approach allowed participants to modify their icons efficiently. Finally, using the designed icons, participants conducted an online brainstorming on a given specific topic (UX/UI redesign).

After the brainstorming session, we conducted quantitative evaluation and FGIs [11] to analyze the effectiveness of the user-generative icons. The quantitative evaluation asked how the experience using the icons improved the online brainstorming experience in terms of effectiveness, efficiency, satisfaction, and immersion [12, 15]. We only used the quantitative results to interpret the qualitative interview data. Then, we conducted FGIs to find out the intended purpose of the created icons, the efficiency of icon usage in brainstorming, and possible future applications.

#### 3.3 Result

In the main study, we collected 67 hand-drawn icons designed by participants, video data in which participants communicated with icons, and interview data regarding icons they created.

By analyzing the icons designed during the main study, we classified the icons’ functions into 6 categories, as shown in Figure 3: 1) *Reaction*, which expresses the listener’s reaction to the speaker; 2) *Speaking order*, which sets the order of speech; 3) *Request*, which requests a specific action; 4) *Status*, which conveys the user’s status; 5) *Excuse*, which requests understanding; and 6) *Indicate*, which calls or indicates someone.

## 4 FINDINGS

To understand how user-generated icons provided better video communication, we analyzed the function of the six icon categories,

Reaction		Speaking order	Request		Status	Excuse	Indicate
Positive	Negative		Direct	Indirect			
The icons in which the listener agrees with the speaker's opinion or express positive feedback.	The icons express that the listener disagrees with the speaker's opinion or has a different opinion.	The icons used to set the order in which multiple meeting participants speak and to form a queue.	The icons expressing an active request by directly requesting a specific action from the other party.	The icons that express one's state and indirectly request a specific action from the other person.	The icons that express one's status and behavior, which is difficult to show through the camera and screen.	The icons used to ask the other person for an understanding of excuse during communication.	The icons for calling or indicating someone in a communication situation with multiple people.
I agree with you GOOD IDEA GOOD Agree	I hat is not true I dont think so Disagree	NEXT WAIT I want to add something After You	Speak Again Please save this document LOWER!! Can you hear my voice? Please share your screen	CANNOT HEAR I can't see Your voice is breaking up I couldn't hear well	I'm typing now Thinking... I can't say now I'm talking now I'm carefully listening I'm really concentrating	Stepped out TOILET I NEED SUGAR I need to out in 10 minutes	Hey! WONyoung Jac HEY hogu 302 (For indicating someone through the screen)

Figure 3: 6 categories in function of user-designed icons from participatory design session.

the FGI data, and the interaction video data of icon-based communication. Consequently, we uncovered new opportunity elements of user-generated icons for a more seamless online communication compared to when using the current icon system.

#### 4.1 Better turn-taking through the combination of icons

In this study, participants used *Speaking order* icons to determine the speaking order during brainstorming sessions. Notably, an emergence occurred when *Speaking order* icons were combined with *Indicate* icons. When P5 and P6 attached the “Next” icon at the same time, P6 told P5 to go ahead by using an “After you” icon. As P5 started his speech, P6 combined her “Next” icon with an icon writing P5’s name, to show that she was waiting in line to speak after P5. Later on, other participants started following this method, and at last a virtual queue for the conversation was created.

*After I finished talking, there was a lot of time wasted in choosing the next person who wanted to speak, but thanks to the “Next” icons that were on the screen in order, it was definitely efficient in terms of turn-taking.... I thought this was a very efficient way to communicate within a set amount of time. (P7)*

Participants became much more aware of the speaking order by designating their own turns using icons. Participants were able to begin their speech as soon as the previous speaker was finished, which reduced the time that was previously wasted determining the speaking order. In addition, participants were less likely to interrupt the current speaker. Thus, participants could not only rapidly take turns, but also express their opinions completely. Although ZOOM currently provides a *Raise hand* function using the “🙋” icon, the fixed shape of the icon cannot sufficiently express a detailed speaking order when multiple users use it, so it is not as helpful as it should be. Therefore, a new icon system that further reflects the user needs is necessary to improve turn-taking in video communication.

#### 4.2 A broader range of reactions through diversity in icon shape and size

In this study, user-designed icons with variation in shape and size were helpful for participants especially when showing different ranges of reactions. Even the same emotions were shown in various forms of icons, depending on the degree of emotion that the participant wanted to convey. For example, all *Reaction* icons that appear in Figure 5 were used to express agreement with the speaker’s opinion. Whereas P3 used a simple icon with text that said “I agree,” P4

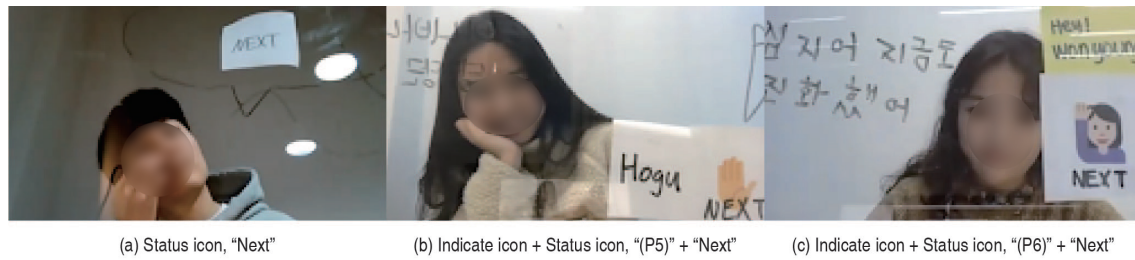


Figure 4: A situation where 3 out of 4 participants created a queue through the *Speaking order* icons.

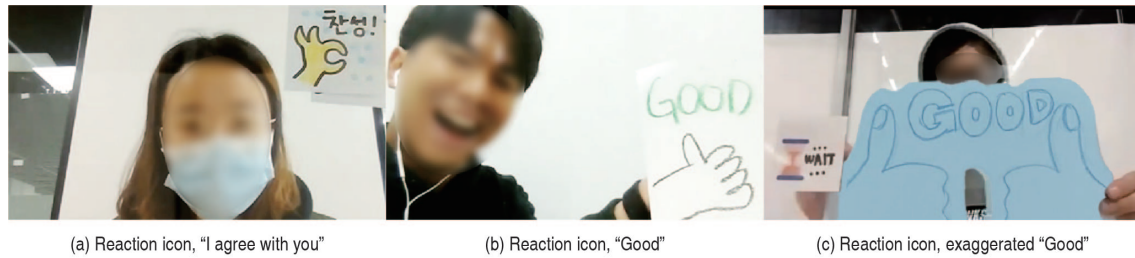


Figure 5: ZOOM screen examples of participants who are using various *Reaction* icons.

used an icon of exaggerated size featuring two thumbs up, showing much stronger agreement with the speaker (Figure 6).

Currently ZOOM includes only a finite set of icons with fixed shape and size. Therefore, users cannot react dynamically or express their emotions fully. This limitation of emotional expression results in a monotonic mood, making the overall communication dull and tedious. We assumed that a new icon system that provides diversity in icon shape and size would let users express their reactions fully.

### 4.3 Revealing users’ difficult-to-notice states and actions through new types of icons

Because screens in ZOOM show users only from the shoulders up in a limited rectangular frame, it is difficult to grasp their complete

states and actions. Because of this limitation, participants often misunderstand each other’s actions. For example, P1 and P2 assumed that P3 was not focusing on the meeting because he was not looking at the camera. However, P3 was actually writing down memos on his notebook, and was in fact fully concentrating in the dialogue.

To resolve such misunderstandings that result from insufficient information, participants in our study revealed their states and actions using *Status* icons.

For instance, P7, who was frequently in charge of archiving the conversation, designed an “I am typing” icon. With this icon, P7 intended to prevent others from presuming she was doing something else. In addition, P1, P4, and P6 used “I am thinking” and “I am listening” icons to show they are still engaged in brainstorming, although they were not speaking at the moment.

[Dialogue]

When I was using the “I am listening” icon, I thought that if other people looked at my screen, this icon would make them think, ‘Oh (P1) is listening to other people’s speech really carefully.’ (P1)

You’re (P1) right, I think it’s similar to when we express that we are listening well using the motion of bringing our hands to our ears during the meeting, so I really liked the (P1’s) “I am listening” icon. (P2)

*Status* icons were mostly used by non-speaking participants to excuse their silence and show that they were still engaged (Figure 7). Speakers claimed to be more satisfied, since they could be assured that the participants were paying attention. Such online brainstorming experiences helped create a communicative atmosphere, lowering the barriers of exchanging opinions. Therefore, a new icon system that reveals users’ difficult-to-notice states and actions may help better collaborative design communication.



Figure 6: Diverse icon examples to express a broader range of reactions.

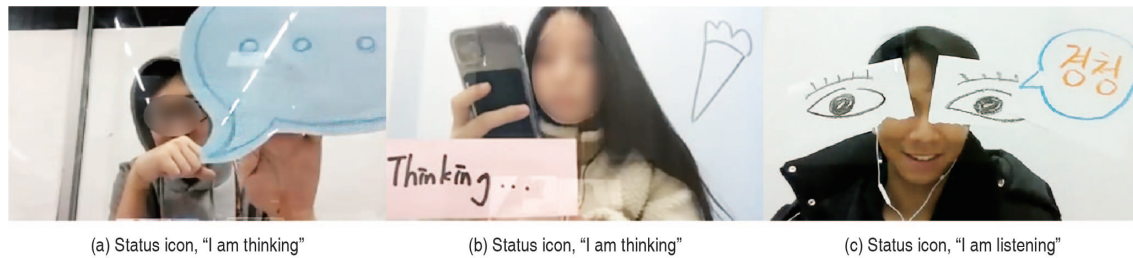


Figure 7: ZOOM screen examples of participants who are using various *Status* icons.

## 5 LIMITATIONS AND FUTURE WORK

Although the icons were intended to accurately reflect user needs, moments emerged in which some icons were not suitable depending on the type and aspect of the meeting. Icons clearly help break down barriers among users and create a casual atmosphere for sharing ideas, but they might not be appropriate in some contexts, such as in formal meetings. In addition, the functions of the icons used and the mental model of usages were different for each, and consensus is required at the beginning of a meeting.

In addition, we conducted experiments in groups consisting of only 3 or 4 participants. Therefore, participants could proceed with brainstorming while looking at relatively large images of others on their screens and easily check the use of icons. If the screen size allocated to each user decreases due to an increased number of users, the icons will naturally become smaller. Then, it will be difficult for users to notice the icons immediately, and the icon system will not function fully. Therefore, further study is necessary to explore methods that can attract the users' attention to icons, even when they are small.

## 6 CONCLUSION

By conducting an experiment by employing participatory design combined with paper prototyping, we observed how the drawbacks of video communication in design could be resolved using user-designed icons. In our study, users reflected their needs and designed icons in various shapes and sizes, combining pictures and text. This not only facilitated turn-taking during the design process, but also enhanced the effectiveness and utility of icons for video communication. In conclusion, a new icon system that ensures variety and freedom may be the key to creating a positive mood in the online meeting environment.

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