Report

Usability Test BigBlueButton 2.4

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1 Executive Summary

Upon request from the university's center for digital teaching (virtUOS), students at Osnabrück University tested functionalities in BigBlueButton (hereinafter referred to as BBB) which are often used in seminars in a usability test with student participants, and additionally surveyed participants' general impression of the usability of BBB.
This report summarizes the observations that were made during this test and introduces possible redesigns for those UI sections which regularly caused friction for test participants.

Our participants' ratings indicate that the overall usability of BBB can be described as 'marginally acceptable'. The ratings of participants who during the test had to use advanced presenter functionalities, such as conducting a poll or uploading slides, were noticeably worse than the ratings of those participants who had to complete more basic tasks, such as using the shared notes or setting a status.
Participants by and large agreed that through an introductory tutorial, they would get used to the overall design logic of BBB. One participant who used BBB for the first time during the test summarized it like this: "The fact that you have various functionalities – that you can share your screen, upload [slides], and all that – is pretty cool, but it is not intuitive to use, I would say. I would not be able to just sit down and give a lecture [in BBB]; I would first need to study the application" (translated from German).
As for what could be concretely implemented to improve the usability of BBB, the following table lists those functionalities which caused problems for a great portion of our participants in a way that markedly limited usage, and very shortly summarizes the UI changes we propose to overcome these problems.

Functionality	Problem	Severity Score[1]	Proposal	Section
Uploading slides	Placement	30	Unified presentation button	3.2.2.1
Reducing one's data consumption	Lacking awareness	26	Change placement and adjust connection status button	3.2.1.4
Layout types	Unnecessary complexity	20	Dissolve redundancies	3.2.4.3
Hide user list panel independently of chat / shared notes	Not implemented – space-intensive	20	Add functionalities for hiding and minimizing the user list panel	3.2.4.2

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[1] The severity score derives from combining the proportion of users that encountered a given problem combined with the extent of the negative consequences this problem entails. The way we calculated severity scores allows values in the range from 1 to 30.

2 About the Usability Test

2.1 Background

At Osnabrück University, every summer term a practice-oriented course on Human-Computer Interaction is being held, where students gain hands-on experience in usability engineering methods such as usability testing. In the summer term of 2022, upon request from the university's center for digital teaching (virtUOS), the task was to conduct a usability test for BigBlueButton (hereinafter referred to as BBB).

From designing the study to writing this report, the usability test was carried out by students with a background in computer science, cognitive science and psychology under the supervision of apl. Prof. Dr. Kai-Christoph Hamborg.

2.2 Goals

The overarching goal of this study was to evaluate the usability of BBB for presenters and viewers, especially with respect to functionalities that are used during online seminars, such as managing presentations, using the chat, and taking measures to save bandwidth.

More concretely, we analyzed how participants solved predefined tasks in order to identify usability problems. On the basis of these problems, we then sketched possible redesigns for the corresponding UI sections which we think could work as solutions.

Additionally, we surveyed participants' general impression of the usability of BBB.

2.3 Methods

2.3.1 Participant Roles & Tasks

To systematically test the usability of functionalities in both the presenter role and the viewer role in BBB, we divided participants into two groups, 'Presenters' and 'Viewers'. The group a participant belonged to determined the set of tasks which the participant would have to complete during the test. Due to the larger variety of functions available to the presenter, Presenters had to complete more tasks than Viewers. English translations of the task sheets can be found in the appendix.

We structured the two sets of tasks such that we could test one Presenter-Viewer pair per test session. This allowed us to efficiently gather data also on aspects which require multiple users, such as noticing an incoming text message or publishing the results of a poll.

In test sessions where only one Presenter participant was present, one of us filled in for the missing Viewer and performed those tasks that are important for the tasks of the Presenter participant to make sense (such as writing in the chat, voting in a poll etc.).

2.3.2 Identifying Usability Problems

In order to later be able to identify usability problems, we recorded participants' screen and utterances (and in the case of Presenters, also their facial expressions) while they solved the set of tasks we gave them. After they had completed all tasks, we interviewed them separately about those situations in which they had deviated from a task's optimal solution path, in order to find out what caused the digression. With Presenters, we used the just obtained screen recordings as the basis for discussion.

2.3.3 Assessing Participants' General Impression

At the very end of each testing session, we had participants fill out the System Usability Scale (SUS) questionnaire, which is a generally recognized and validated tool in usability research for assessing users' general impression of a product's usability. The SUS questionnaire consists of ten statements about the design of the product. Participants respond by indicating the extent to which they agree with each statement. From these responses, a score between 0 and 100 can be calculated – the so-called SUS score – which then quantifies the respondent's general impression of the product's usability.

2.3.4 Bringing it all together: Testing Procedure

We tested with one to two participants per testing session. One testing session comprised four steps:

1. First of all, participants filled out the pre-test questionnaire, by which we ascertained each participant's prior experience with BBB.
2. In the second step, both participants were shown a PDF file with general instructions and their respective set of tasks. They then entered the same BBB meeting room and completed their tasks.
3. After both participants had completed their tasks, we interviewed them separately, asking them about their goals, expectations, and confidence while navigating the user interface.
4. Finally, each participant filled out the SUS questionnaire.
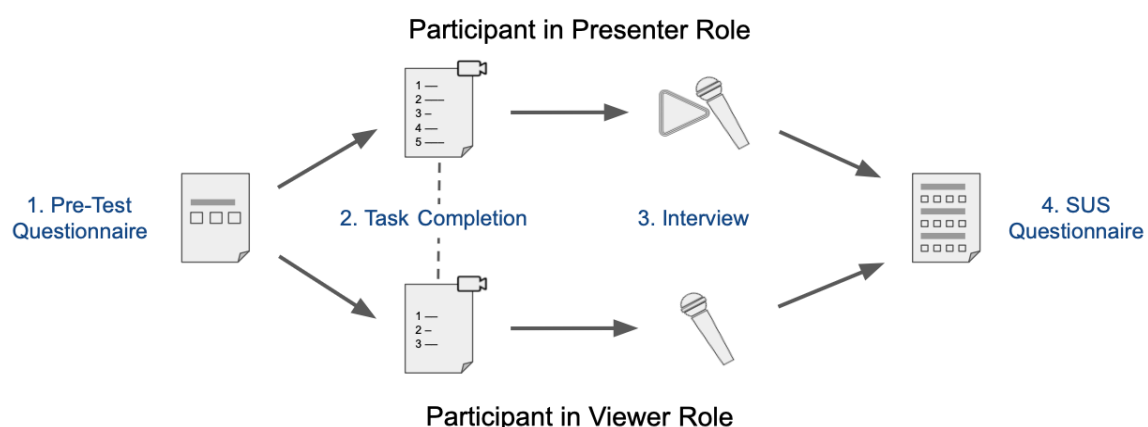
The structure of a test session

2.4 Testing Environment

The test was conducted in the usability lab of Osnabrück University. There, Presenters completed their tasks on a Windows 10 computer which was connected to a 27-inch QHD monitor (Dell P2720D), while Viewers completed their tasks on a fourth-generation 13-inch Apple MacBook Pro.

2.5 Participants

2.5.1 Recruitment

Participants were recruited via several student body mailing lists, the university's digital notice board and word of mouth. As compensation, we offered two 'Study Participant Hours' (which students in psychology and cognitive science at Osnabrück University need to collect a certain amount of in order to be able to graduate).

2.5.2 Overview

We acquired 10 participants for this study. While this might seem like a very small sample, note that data from 5 participants or more per user group is generally deemed to provide a good basis for identifying usability problems (see Rubin & Chisnell 2008, Tullis & Albert 2008). Still, this makes our investigation of participants' general impression of the usability of BBB less reliable.

All participants were students under the age of 30 and spoke German as their native language. (The test was conducted entirely in German.) Two participants had relatively little experience in BBB. One of them used BBB for the first time during the test. But even the more experienced participants were familiar only with the viewer role; at most, they had shared their screen to present homework.

For an overview of all test participants, see the table on the following page.

Participant	How long have you been using BBB for?	How often do you use BBB?	Predominantly used role
P1	more than 1 year	several times a week	viewer
P2	more than 1 year	several times a week	viewer
P3	more than 1 year	several times a week	viewer
P4	more than 1 year	weekly	viewer
P5	more than 1 year	weekly	viewer
P6	more than 1 year	monthly	viewer
P7	more than 6 months	several times a week	viewer
P8	more than 6 months	weekly	viewer
P9	more than 1 month	monthly	viewer
P10	I have never used BBB	–	–

Overview of all test participants

2.5.3 Allocation to Roles

Participants P3, P7, and P9 were allocated to the Viewer group. The seven remaining participants were allocated to the Presenter group.

The imbalance in the participant groups is due to few participants signing up for the same time frame.

3 Findings

In the following, we present our findings regarding participants' general impression of the usability of BBB, describe which tasks regularly caused difficulties for participants and in what ways, and propose sectional redesigns which could preempt such difficulties in the future.

3.1 Participants' General Impression of Usability

3.1.1 Average SUS Score

By averaging over the SUS scores following from participants' responses to the SUS questionnaire, we obtained a mean SUS score of 63.5 / 100 for BBB. The margin of error of

the corresponding 95% confidence interval is roughly 13.4, meaning that the true SUS score of BBB resides in the interval (50.1, 76.9) with 95% statistical confidence.

### 3.1.1.1 Comparison to other products

Bangor et al. (2008) collected 3,463 SUS scores from 273 studies and found a median SUS score of 70. Tullis and Albert (2008) collected 129 average SUS scores from 50 studies and found a median of 68.9 and a mean of 66.4. According to these results, BBB was rated below average in terms of usability by our participants.

However, the conclusion that the usability of BBB is substandard should be taken with a grain of salt, as 1) the medians identified in the two aforementioned studies are contained in the 95% confidence interval and 2) both studies considered SUS scores that were obtained in tests with a wide range of products (including e.g. hardware products and voice UIs), so there are limitations to the validity of the comparison. In particular, these results do not allow us to conclude that the usability of BBB is substandard in the field of web conferencing applications.

Nevertheless, we cannot avoid the fact that the greater part of the 95% confidence interval is contained in the range from 50 to 70. Bangor et al. (2008) designate SUS scores in this range as 'marginally acceptable'.

3.1.2 Overview of Responses

The following chart shows the responses of all participants to each of the statements. Positive statements are arranged on the left, negative statements are arranged on the right.
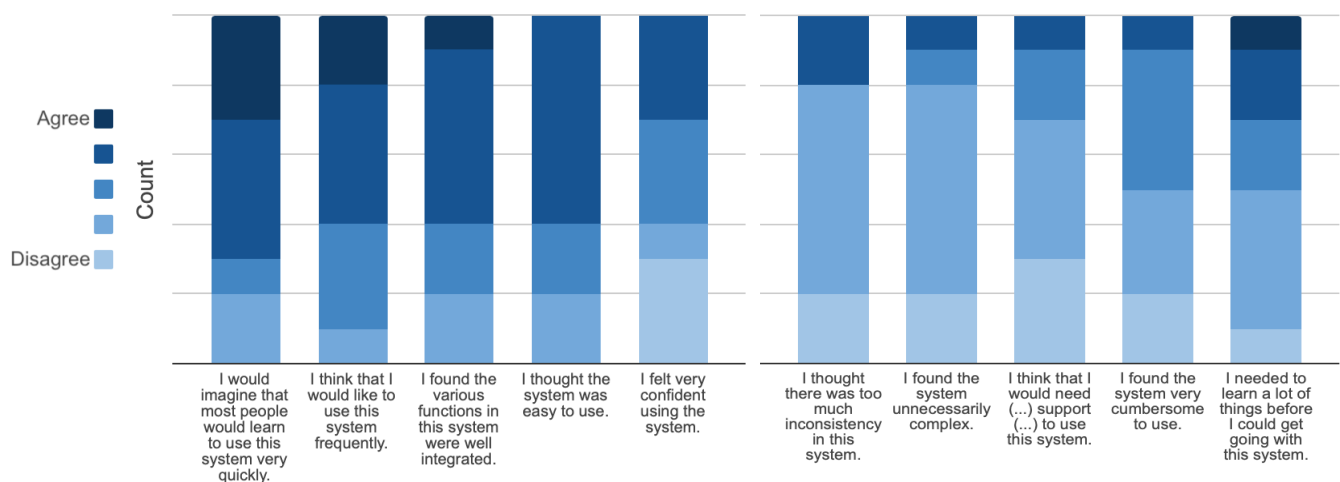
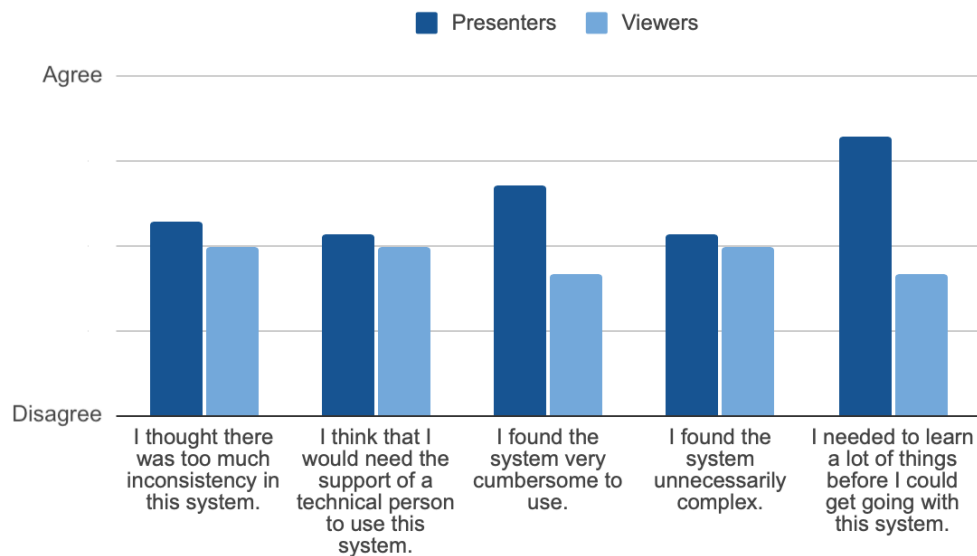*Responses to the SUS questionnaire*

Notice especially that none of the participants fully agreed with the statements "I thought the system was easy to use" and "I felt very confident using the system", and three participants completely disagreed with the latter statement. Three participants fully or rather agreed with the statement "I needed to learn a lot of things before I could get going with this system".

3.1.2.1 Differences with respect to participant roles

There are some interesting tendencies to observe when comparing the average agreement ratings of Presenters and Viewers to the negative statements.

As can be seen in the following chart, Presenters, i.e. those participants who were confronted with some advanced functionalities which they mostly did not previously know, generally tended to assign higher agreement ratings to negative statements, which is especially notable regarding the statements "I found the system very cumbersome to use" and "I needed to learn a lot of things before I could get going with this system".

Average responses of Presenters and Viewers to the SUS questionnaire

3.2 Usability Problems and Proposed Solutions

In this section of the report, we go through the functionalities we tested and summarize our observations for each one. We structured this section according to the four categories into which we grouped the tasks: Session participation, presenting, user interaction, and layout manipulation. Where we identified usability problems, we propose solutions. Redesign sketches can be distinguished from screenshots of the current BBB UI design by a green corner overlay.

3.2.1 Session Participation

3.2.1.1 Unmuting one's microphone, activating one's camera

10/10 participants used these functionalities without any difficulties.

3.2.1.2 Muting one's microphone (and switching one's mode of participation)

6/7 Presenters completed the task to mute their microphone without any problems. Only the participant who used BBB for the first time in the test (P10) without any hesitation clicked the "Leave audio" button.

Due to a specific request by virtUOS, we asked all Presenters about what they associate with the "Leave audio" button. The responses were diverse: While the above-mentioned participant apparently thought this was the button that would allow them to mute themselves, 4/7 thought they would stay unmuted, but not be able to hear others anymore when clicking it, and 2/7 primarily associated with this button that it allows them to switch their mode of participation (from "Listen only" to "Microphone" or vice versa). While this latter functionality can be reached via the "Leave audio" button, it is not the action that is actually performed when clicking this button. Instead, you will leave all audio streams, meaning others will not be able to hear you and you will not be able to hear others.
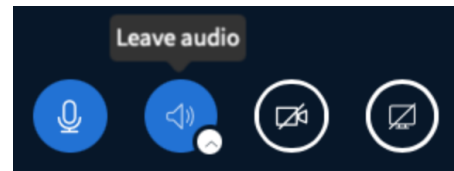
We think that the way these two functions, leaving all audio streams on the one hand and switching your mode of participation on the other, are represented in BBB 2.4, does not match the frequency with which they are respectively being used. While it is relatively hard to imagine a situation in which leaving all audio streams would be desired (perhaps explaining why none of the Presenters could correctly recall the function of the "Leave audio" button), in our experience it is not rare to switch one's mode of participation during a lecture or seminar meeting. But while the leaving all audio streams functionality is placed front and center in the form of the "Leave audio" button, requiring just one click, switching modes of participation requires three clicks (clicking firstly "Leave audio", then "Join audio", and then selecting a mode) and is also not straightforwardly detectable – one participant who had been using BBB for six months did not know she could switch her mode of participation within the application, and consequently rejoined the meeting each time she wanted to do so.

In order to address this imbalance, make the functionality more discoverable, and simplify the center bottom icon bar, we propose to remove the "Leave audio" button from the main screen and relocate it to the audio selector, and additionally expand the audio selector by a button for switching to the respectively other mode of participation with just one click.

Partly, corresponding changes are already underway – in response to GitHub issue #12914, Tyler Copeland redesigned the audio selector to include the "Leave audio" functionality, which has by now been implemented (see PR #15154) and is scheduled for release in BBB 2.6:
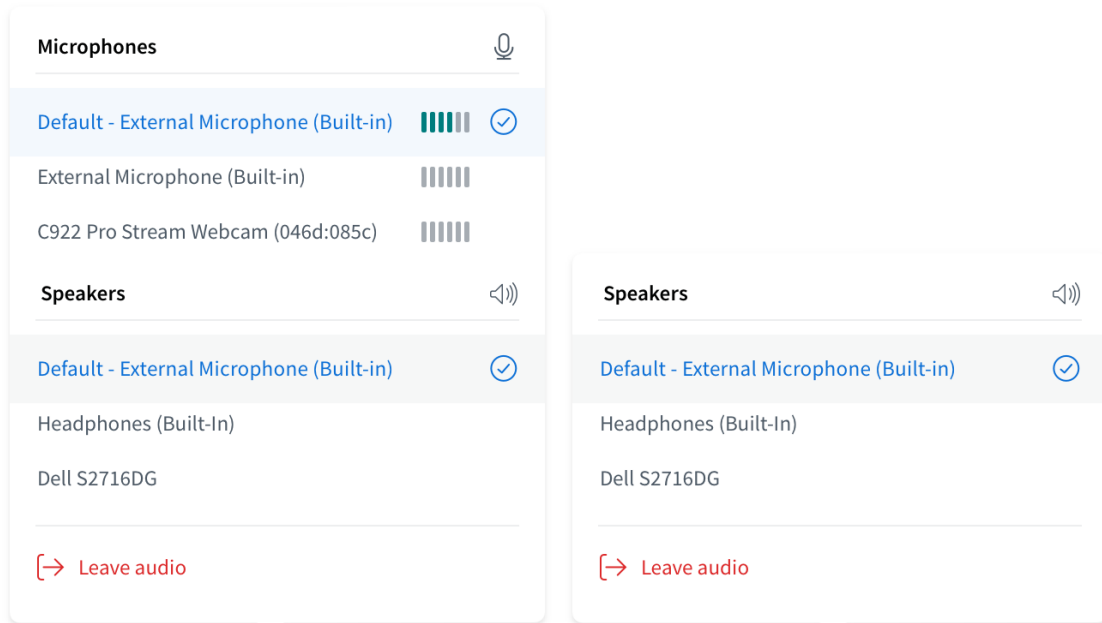
Tyler Copeland's redesign of the audio selector

However, with this redesign, four clicks are required to switch participation modes, instead of three in BBB 2.4 and 2.5. If a dedicated button were placed in the microphone selection menu (which we thought would make sense, since the key difference between participation modes concerns the ability to select a microphone), only two clicks would be required to switch to the respective mode of participation. Below is a sketch for what we think this could look like:
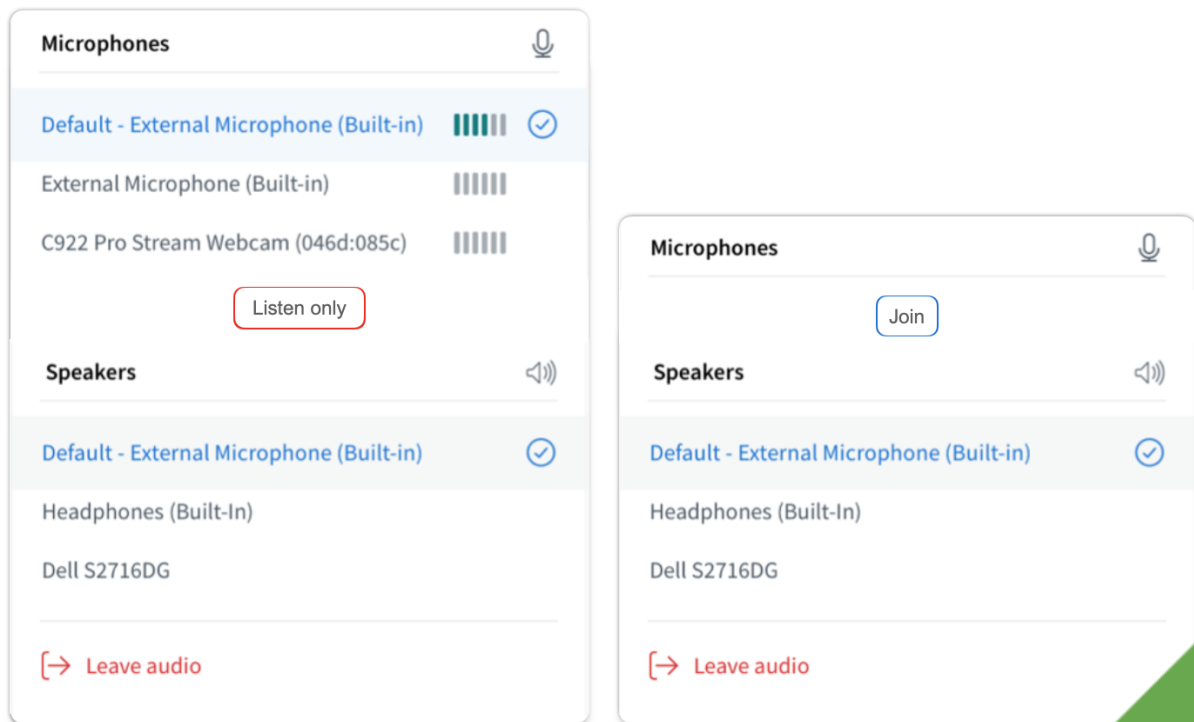
Tyler's redesign, plus a button for switching one's mode of participation

Alternatively, The "Join" button could also be placed in the "Microphones" heading. Or, the "Microphones" heading could be removed such that only a "Join with microphone" button is shown.

We did not consider alternative placements for the "Listen only" button, as it is functionally similar to the "Leave audio" button which is placed at the very bottom of the audio device selection menu, and placing the "Listen only" button below the microphone options in our opinion nicely mirrors this similarity.
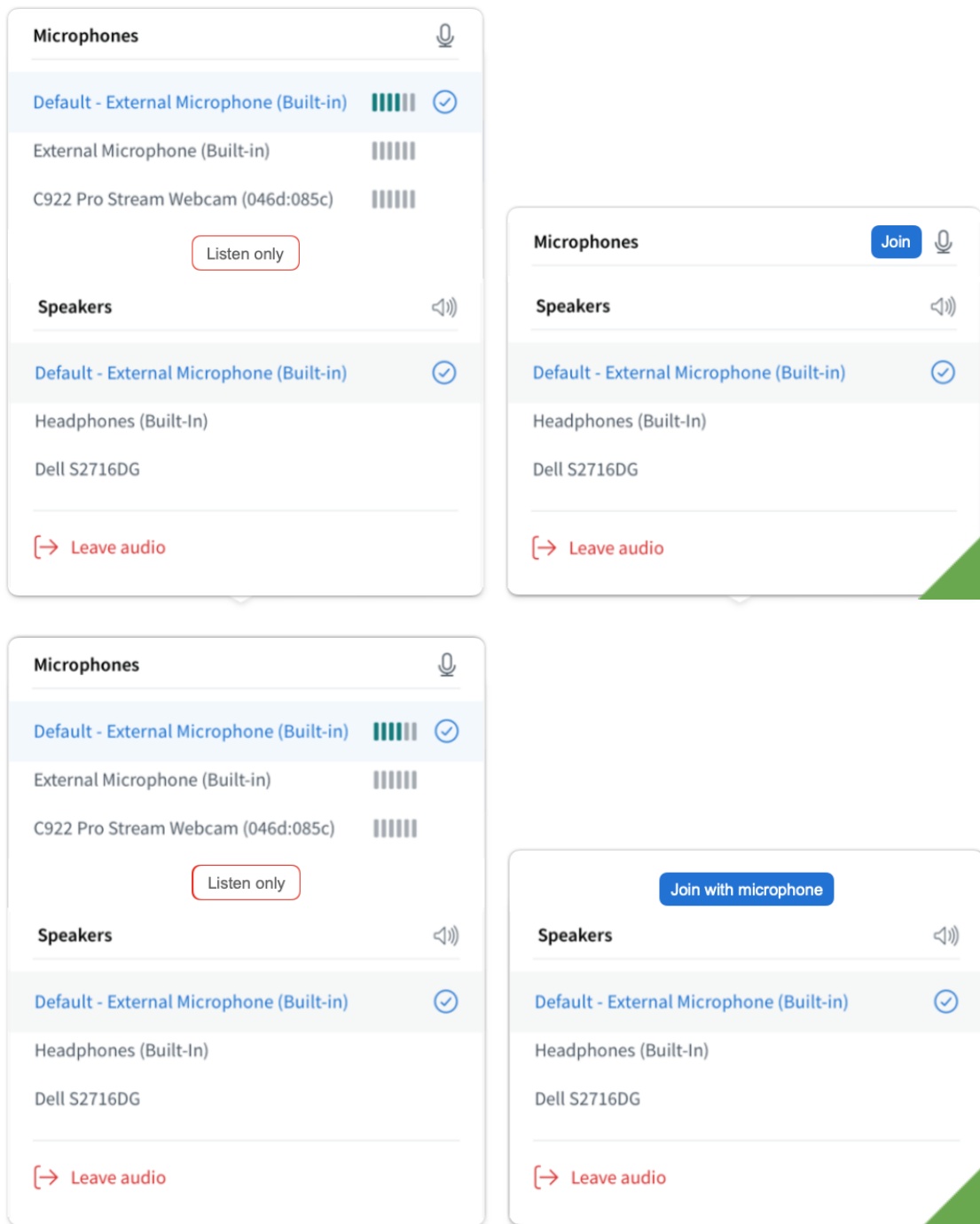
Alternative placements of the "Join with microphone" button

3.2.1.3 Using a virtual background

Participants who were assigned the 'Viewer' role had one task that asked them to use a virtual background, which directly followed a task asking them to join the meeting such that others could hear and see them (i.e. activate their microphone and camera). When you activate your webcam, the webcam settings window opens, which also contains the option to activate a virtual background. 2/3 participants had already read ahead in the task sheet or checked it before closing the webcam settings window, meaning they did not have to figure out that in order to activate a virtual background, they would have to open the webcam settings via the "Open advanced settings" button below the webcam symbol. Consequently, these two participants did not face any problems with this task.
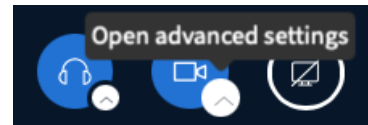
Things look different for the remaining Viewer participant: She found out that she had to activate a virtual background only after closing the webcam settings window, and then searched the UI for a while, exploring at first her own webcam window, then the options, the settings, and the user list panel with 11 actions (by which we mean clicks, hovers) in total before deactivating her webcam and then reactivating it, and thereby opening the webcam settings window. She did not seem to notice the expansion button below the webcam symbol that would have allowed her to open the webcam settings window without reactivating her webcam.

However, the second action she performed during her search was to click her name in the corner of her webcam window, where she found options to mirror or pin her webcam – we think that it would be worth considering to also place a button for using a virtual background here, or a link to the webcam settings.

3.2.1.4 Reducing one's data consumption

3.2.1.4.1 Placement of the data savings options

In BBB 2.4, there were two ways in which one could reach the options for data savings. You could either click the connection status symbol in the upper right of the main screen, or open the "Options" menu, click "Settings", and then go to "Data savings". With the introduction of BBB 2.5 however, the options for data savings were removed from the connection status menu and are now accessible only via the settings. Especially since the connection status symbol in the top right of the main screen visually responds to a worsening connection quality, it would make sense to us to be able to find the data savings options also in the connection status menu. This would moreover reduce the number of clicks required to get to them, which we think is important because 1) some users need to use these options rather often, and 2) in case of a weak connection, one is under pressure to stabilize it as quickly as possible in order to be able to follow the meeting.

3.2.1.4.2 Users' awareness about the existence of the data savings options

In our test, only 1/7 participants knew that the data savings options exist. Remember here that most of our participants were experienced in using BBB (they had a median experience

with BBB of more than one year of weekly usage), and will therefore likely have faced connection problems before, which they then weren't able to adequately handle due to their lacking awareness of the existence of these options. We think therefore that increasing the awareness for the data savings options is rather important. This could be achieved by having the connection status button not only turn red when the connection becomes worse, but also get expanded by a direct link to the data savings options:

Expansion of the connection status button in case of a weak connection

3.2.1.4.3 What the data savings options functionally hold

In BBB 2.4 and 2.5, there are two options for reducing one's data consumption: One is to leave all other users' webcam streams, the other is to disable the screen sharing feature. Two of our participants said they had expected more graded options. Together with them, we developed ideas about which additional data savings options might be useful, and arrived at the following suggestions: Firstly, one option each for throttling the transmission quality of the webcam and screen sharing streams, and secondly, an option to specify that not all webcams should be displayed, but only, for example, that of the presenter or that of the sign language interpreter. An implementation of this could look as follows:
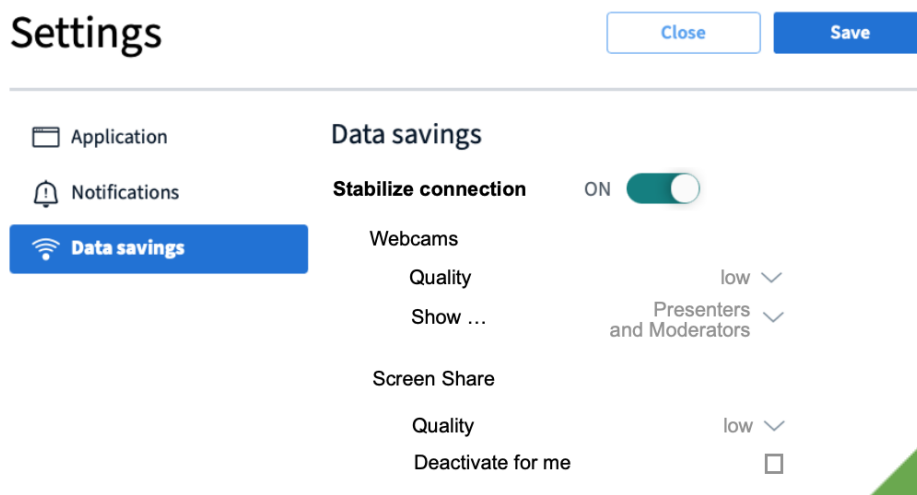
Additional data savings functionalities

Having four options to individually adjust may not always be desirable – especially if you are experiencing connection problems and don't want to miss what anyone is saying. This is why we subordinated the four options to an overarching function, which we called "Stabilize connection". Similarly to "low power mode" functionalities on mobile devices, this could activate certain default settings for the individual options, such that significant data savings can be obtained with a single click. It may be worth considering to show a visual cue in the

main screen in case "Stabilize connection" is active, such as turning the connection status symbol yellow, or displaying a thin yellow ring around it to avoid that it gets misinterpreted as an indicator for a moderate connection quality. Using yellow as a color may allow users to draw a connection to 'low power mode' functionalities they are familiar with.

A suggestion for refinement we received as feedback when we presented this redesign proposal at the BBB Community Meeting D/A/CH this summer was to offer users not just a single preset which they could activate by turning on "Stabilize connection", but multiple presets which vary with respect to the amount of bandwidth they free up. One point of criticism of this additional proposal could be that it makes the functionality too complex overall.

3.2.1.5 Leaving the meeting

The 9/10 participants who had prior experience with BBB left the meeting without any difficulties (5 used the "Leave meeting" button, 4 closed the tab). The first-time user P10 searched for a dedicated button, and found the "Leave meeting" button after 14 seconds of searching the main screen and clicking the "User list toggle" button (we will get back to this in section 3.2.4.2.3).

Participants were divided on the question of whether the "Leave meeting" button should be repositioned: 3/10 participants (including P10) explicitly noted that there should be a dedicated button for leaving the meeting directly on the main screen, while 2/10 participants stated that they would not endorse this, as they would be afraid to accidentally click on it during the meeting.

We think that the placement of the "Leave meeting" button does not pose a significant usability problem. If we had to propose an alternative, we would mention that a compromise between the two positions described in the paragraph above could be to move the "Leave meeting" button to the lower end of the user list panel, and to follow up a click on this button with a short confirmation dialog, where users need to click once more to confirm that they do want to leave the meeting. But we are not confident that this would necessarily mean an improvement over the current design.

We also noticed a blue-red contrast when hovering the "Leave meeting" button in BBB 2.4, which gave rise to a chromostereoptic effect and thus hindered readability, but this is alleviated in BBB 2.5.
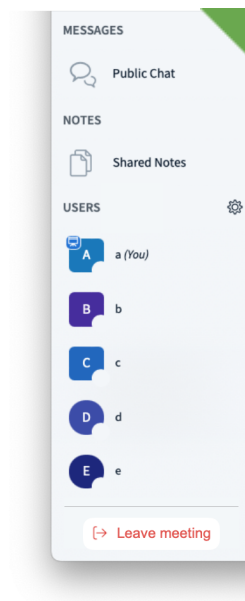
3.2.2 Presenting

3.2.2.1 Uploading slides

3.2.2.1.1 Awareness regarding the functionality

Participants in the 'Presenter' group had the task to open a given PDF file in BBB. We intentionally did not specify that we expected them to upload the file, in order to get an idea

about whether the participants were aware that this is possible as an alternative to screen sharing. 3/7 participants simply shared their screen, and then each individually confirmed in the ensuing interview that they thought they had thus exhausted all possibilities. Two of them had been using BBB for more than a year.

3.2.2.1.2 Placement of the functionality

On average, those 5/7 participants who did eventually find the "Manage presentations" button in the "Actions" menu took 5 actions to do so (counting only those actions which participants performed as they were trying to upload the slides, i.e. not those they carried out as they were trying to share their screen). The other 2 participants in the Presenter role respectively gave up on the task after slightly more than 2.5 minutes of unsuccessful searching (8 and 13 actions respectively) – both noted that they had not perceived the "Actions" button. (One explanation for this could be that the visually very salient contrast between the white chat and the dark blue background of the presentation area overshadows the salience of the "Actions" button with its weaker light blue-dark blue contrast.)

What is interesting is that three participants began their search at the "Minimize presentation" button (which shows a flipboard icon), and three other participants started their search at the "Share your screen" button.

3.2.2.1.3 Redesign proposal: "Actions" menu

The "Actions" menu contains all presenter functionalities. But besides being available only to the presenter, there is little that these functionalities have in common. This heterogeneity allows only a rather unspecific menu title and icon, which in turn prevents this menu from getting users' attention when it really should, and predisposes it to getting attention when it should not. We therefore suggest to dissolve the "Actions" button, and move the functionalities it currently holds to locations where users may initially expect them – for the "Manage presentations" functionality, this could mean placing it in a menu together with the screen sharing functionality. By adding also the "Share an external video" functionality to this menu, users could find all functionalities concerning the presentation area in one place.[2] Here is a sketch of what this could look like:

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[2] Ideas for where to alternatively place the other buttons which can currently be found in the "Actions" menu are presented in section 3.2.2.5.1 ("Start a poll" and "Select random user" buttons) and section 3.2.4.3 ("Propagate layout" and "Layout Settings Modal" buttons).
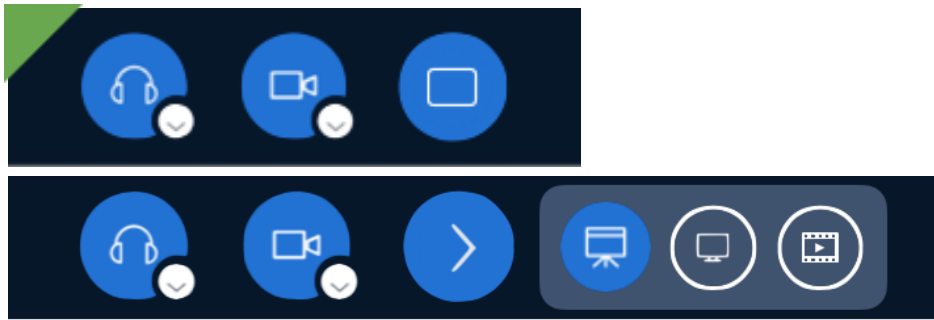
Unified button for the presentation area, collapsed and expanded

Displaying the presentation tools as sketched above would not only help to increase users' awareness about the option to upload slides (which would be important especially considering that this is not a widespread feature in video conferencing applications), but moreover has the advantage of enabling the presenter to see at a glance which tools are currently active, alleviating confusion around having e.g. an external video displayed on top of a presentation. It would also allow this hierarchy to be visualized (e.g. by displaying the "Manage presentations" button in a darker blue), and enable more localized dialogs for selecting an external video to share and managing presentations (see below).

This unified presentation tools menu would also be suited to house the option for assigning a webcam to the presentation area (see GitHub issue #15468).

3.2.2.1.4 Redesign proposal: "Manage presentations"

While we are at it, let us also consider the dialog that clicking the "Manage presentations" button invokes. Currently, this dialog takes up the full browser window, offers a checkbox for selecting a presentation between the buttons for removing it and setting its download permissions, and describes the files by their filename. While we did not explicitly address these aspects in the test, in thinking about the BBB UI we identified this as an area that could profit from a redesign.

All options for managing slides comfortably fit into a much more compact window. Condensing the "Manage presentations" dialog as shown in the sketch to the right would allow to display it in a localized window, which may further enable users to utilize spatial memory for handling BBB.

Browsing and selecting files could be made easier by 1) representing files not only by their system name, but also by a thumbnail showing the first page of the file, and 2) highlighting the selected file by a bold contour and checkmark. If more files are uploaded, the window could expand vertically and/or become scrollable.

If in addition advice regarding compatible file types is linked, the explanatory text in the current "Manage presentations"
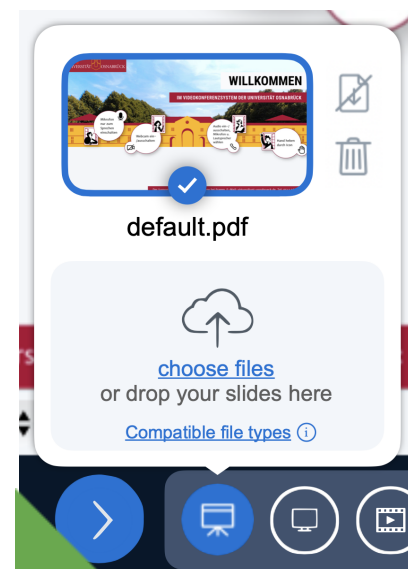
dialog could be removed in order to avoid confronting users with information that is required only in few cases.

It may or may not be useful to place the button for allowing session participants to download the currently active deck of slides not in the "Manage presentations" dialog, but in the menu bar directly below the presentation area. On the one hand, this would make it possible for presenters to make the slides available for download by just one click instead of three, but on the other hand, they could only do so for the file that is currently displayed in the presentation area (which may however cover the vast majority of use cases).

3.2.2.1.5 Redesign proposal: "Minimize presentation"

The participants were drawn to the "Minimize presentation" button not only when trying to upload slides, but e.g. also when trying to take the presenter role or distribute a layout. And as we also used the icon in our proposal above for the managing presentations functionality, we suggest using a different icon for the "Minimize presentation" button, such as a minus, independently of whether a screen is being shared or a presentation has been uploaded, as this does not alter the button's core functionality.

3.2.2.2 Taking the presenter role

2/6 participants were able to take the presenter role without any difficulties. Of the remaining four, one mentally skipped to the next task (opening a given presentation in BBB) and noticed that she had to take the presenter role first only as she stumbled upon the "Take presenter" button in the "Actions" menu. The other three participants needed to search for a while to find the corresponding functionality; one of them (P8) surrendered after searching for slightly more than 2 minutes, the others took 20 seconds (P6) or 50 seconds (P10) respectively to find the "Take presenter" button in the "Actions" menu.

All of those latter three participants checked the bottom center of the main screen before finding the functionality or giving up on the search. We think therefore that their wandering search could be prevented by displaying the unified presentation button (see the proposal in section 3.2.2.1.3) also for currently not presenting moderators and viewers, perhaps grayed out. Upon being clicked, it could offer to take (moderators) or request (viewers) the presenter role. This button could thus serve as an anchor for users' mental concept of the presenter role, which would hopefully help to defuse the disorientation that our participants seemed to experience with respect to the "Take presenter" and "Manage presentations" (see section 3.2.2.1.2) functionalities. Additionally, introducing a functionality that allows users to actively request the presenter role could relieve moderators of always having to find the user who they want to make presenter in the user list.
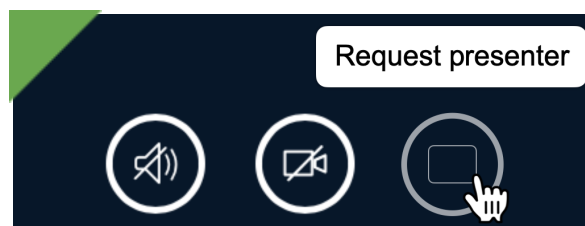

Fig. 11 *Grayed-out version of the unified presentation area button, here for a viewer*

3.2.2.3 Drawing on slides

With the complete overhaul of the whiteboard feature in BBB 2.6, the following observations and remarks essentially do not apply anymore. However, as the observations might still be interesting and may have implications also for the new tldraw whiteboard, we decided to include them in this report.

Only one of the Presenter participants immediately selected the pencil from the tool menu. The other six tried to draw without clicking anything or looking into any menu first; and five of them subsequently went to the "Turn palm rejection on" button before clicking on "Tools".

As toggling palm rejection does not seem to be a feature that most users need frequently, we would suggest moving it to the application settings, or removing the option for toggling altogether and implementing palm rejection as the general manner of functioning of BBB. (However, note here that none of us is very knowledgeable in digital drawing, so it could very well be that we are just not aware of specific use cases where palm rejection is not desired. If the feature remains in the toolbar, we would recommend using an icon that looks less like it enables drawing.)

Additionally, we think that a distinct "pan" tool may not be necessary, as the functionality can be reached via click-and-hold when holding down the space bar, which is less tedious than always having to select a different tool each time one wants to pan an object. Perhaps when creating a text or form object, a hint pointing to this shortcut option could be displayed for a few seconds – even if the panning functionality remains in a separate tool, to raise awareness for this option. Removing the panning functionality from the default whiteboard tool would furthermore allow 1) to rename the default whiteboard tool to "Pointer" and assign to it a corresponding symbol and 2) use the pencil as its click-and-hold functionality, which 6/7 participants presumed.

3.2.2.4 Activating the multi-user whiteboard

All seven Presenter participants waited for the name of the "Turn multi-user whiteboard on" button to appear before clicking it. Two of them explicitly stated that they found the icon ambiguous, and expressed that an icon showing the user symbol which is also used in the "User list toggle" button would be more fitting. Based on this suggestion, we want to propose a redesign of the "Turn multi-user whiteboard on/off" button along the lines of the following sketch:
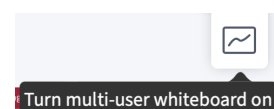
Alternative icons for activating / deactivating the multi-user whiteboard

One participant mentioned that also an icon showing multiple pencils would be suitable. So the following could be an alternative:
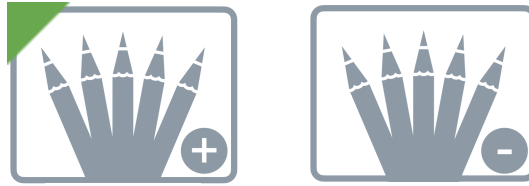
An alternative icon showing pencils instead of the user symbol

If this latter option is chosen, in our opinion tldraw's pencil tool icon should be used.

3.2.2.5 Conducting a poll

3.2.2.5.1 Finding the "Start a poll" button

5/7 participants did not have any difficulties finding the "Start a poll" button in the "Actions" menu, and 2/7 participants found it after a few seconds of searching. Note however that all of them had already seen this button in the "Actions" menu when trying to upload slides – thus from these observations it can not be deduced that users will generally have an easy time finding the "Start a poll" button. For the reasons we state in section 3.2.2.1.3, we suggest moving the "Start a poll" and "Select random user" buttons from the "Actions" menu to the user list panel, as they are both closely associated with the meeting participants. The "Start a poll" button could alternatively also be placed where the "Action" button is currently located. Here are two corresponding mock-ups:
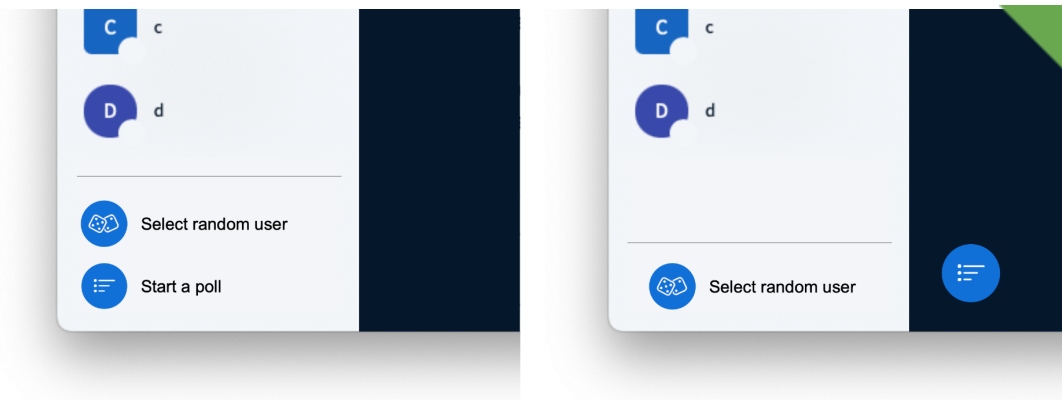
Alternative locations of the "Select random user" and "Start a poll" buttons

We would favor the second option, as this would create a more balanced bottom row in the main screen, and additionally make it possible to more recognizably display when polling options have been detected on the current slide. This is what we were thinking about:
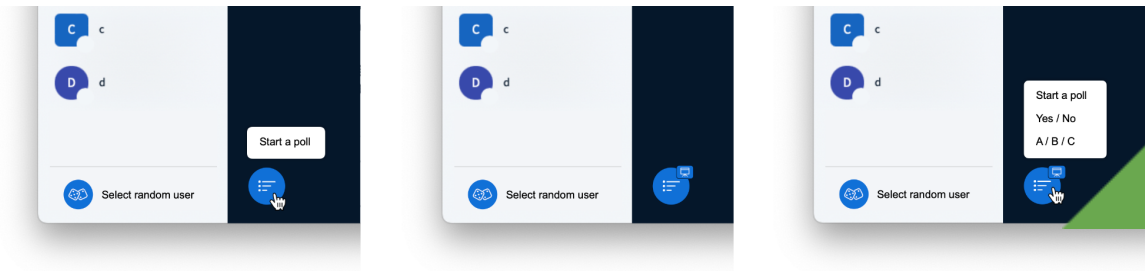
When polling options have been detected on the current slide, a badge could appear on the "Start a poll" button.
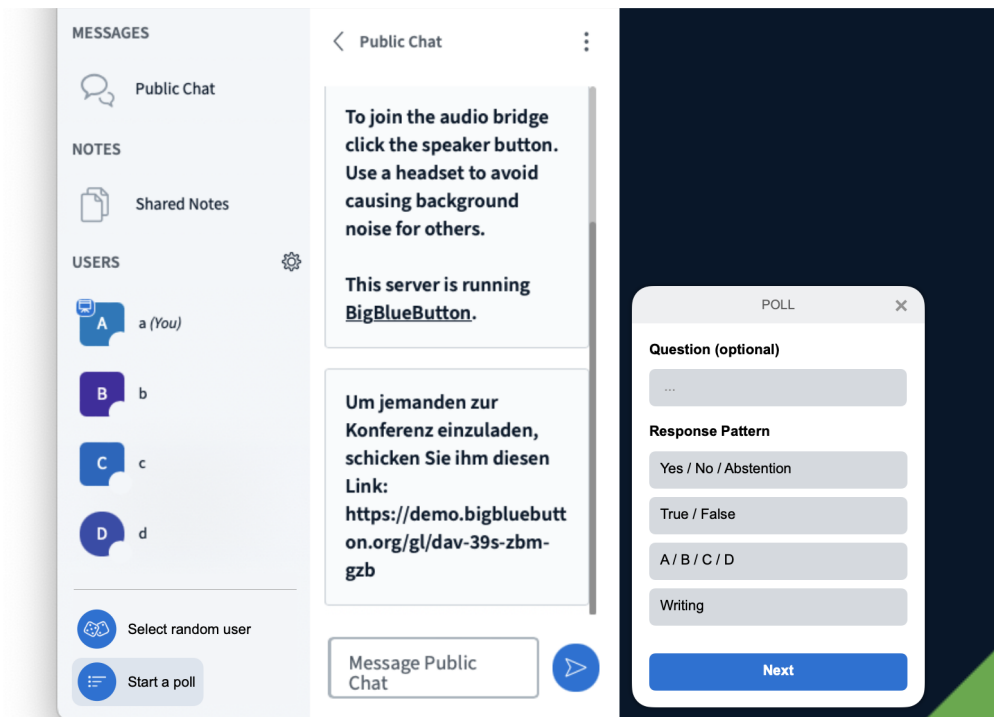
3.2.2.5.2 Creating a poll

7/7 participants were able to create a poll without any difficulties.

3.2.2.5.3 Closing a poll, publishing the results

3/7 participants were confused by the "Publish poll" button, which they interpreted not as referring to the publishing of results, but as functionally similar to "Start poll". Consequently we would suggest retitling the "Publish poll" button to "Publish results".

3.2.2.5.4 Further redesign proposals

We would say that the dialogs for creating a poll and observing incoming responses should not be displayed in the user list panel, as this brings changes to an otherwise very static part of BBB's main screen and thereby contradicts what users believe to know from experience about the interface, which adds to their insecurity in handling BBB. (Remember here participants' restrained agreement ratings to the statement "I felt very confident using the system" (see section 3.1.2).) Instead, the polling dialog could be displayed in a dedicated (and perhaps movable) window within the main screen. This would further allow one to see the chat or the shared notes when creating the poll and observing the results, which can be useful e.g. when one wants to use meeting participants' ideas as options in the poll. Here is a sketch of what this could look like:

*The dialog for creating a poll as a dedicated window*

We also want to propose some changes to the polling dialog itself, which we think enhance its clarity:

➔ rename "Response type" to "Response pattern" for clarity

➔ rename "User response" to something more specific (wouldn't "Yes / No / Abstention" be just as much of a 'user response' as written text?), such as "Writing".

➔ break the dialog down into discrete steps in order to structure it more clearly

➔ allow users to delete also the first two response options (we could not think of any reason that speaks against this from a usability perspective)

➔ uncouple publishing the results of a poll from closing it, as this may be unintuitive, and people perhaps want to publish intermediate results

➔ add a dedicated "close poll" button for closing a poll without publishing the results. Clicking this button should also close the polling dialog (unlike currently, where "Publish poll" closes the poll, but leaves the polling dialog open).
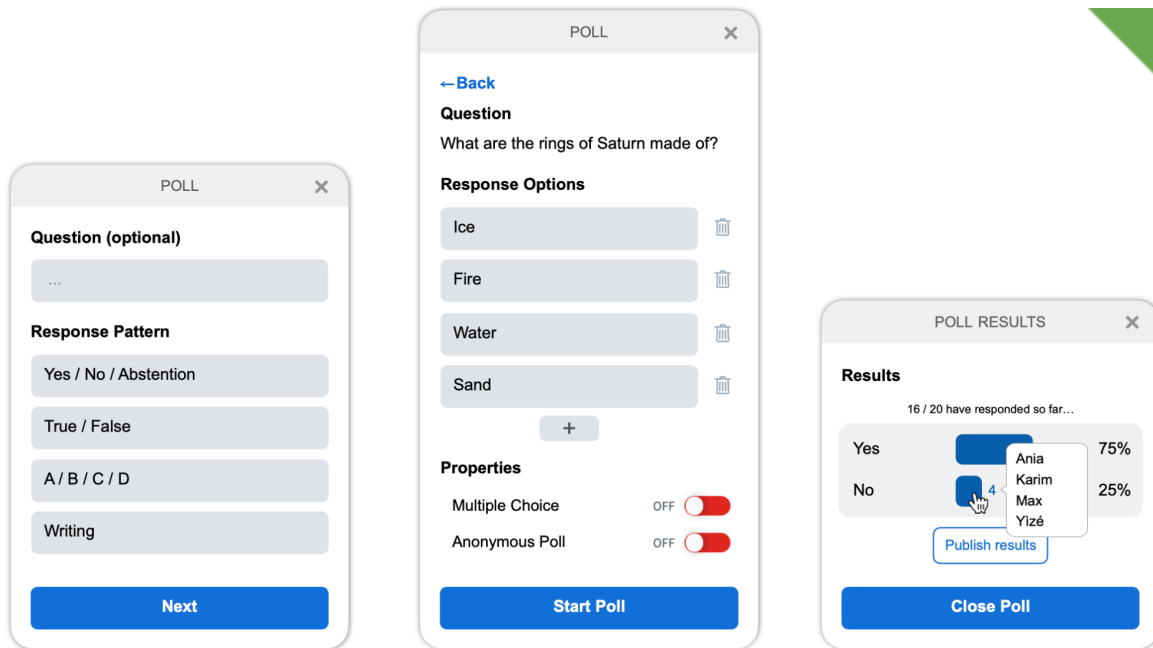
Reworked dialogs for creating a poll and observing incoming responses

We also thought about reducing the choice of a response pattern to a choice between whether users should select or type in their response. If the presenter chooses "Select", it would make sense to provide a default set of options (e.g. "A" and "B" are versatile). "Yes / No / Abstention", "True / False", and "A / B / C / D" could then be selected from a presets menu.
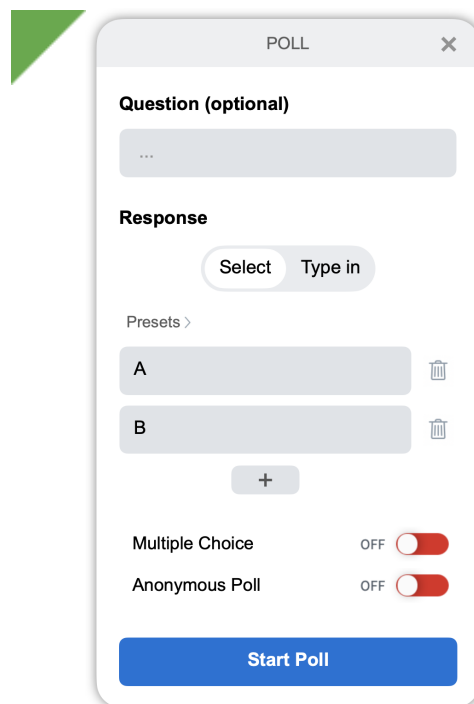
A simpler alternative dialog for creating a poll

3.2.2.6 Screen sharing, muting all users, clearing all status icons

7/7 participants used these functionalities without any difficulties.

3.2.3 User Interaction

We evaluated functionalities for non-oral communication in two respects: On the one hand, we considered whether participants are able to use these functionalities to start an interaction, while on the other hand, we checked whether the respective recipient noticed the contact attempt.

But first, a caveat: While Presenter participants in the instructions at the very top of their task sheet were told to watch for and respond to Viewer participants' efforts to communicate, we had the impression that the tasks we gave them captured too much of their attention for them to be able to notice incoming contact attempts as sensitively as they probably would during a regular BBB session. Additionally, one of the first tasks for Presenters was to hide the user list panel, which of course makes incoming chat messages or changes in the shared notes harder to perceive. Keep this in mind when reading the following observations about the noticeability of BBB communication functionalities.

3.2.3.1 Chat (public and private)

3.2.3.1.1 Sending messages

All test participants were able to send messages to the public chat as well as private chats without any difficulties.

3.2.3.1.2 Noticing incoming messages

Only one of the seven Presenter participants quickly noticed the incoming message in the public chat (at the time, she was writing a private chat message herself). When opening the user list panel in order to be able to solve a later task, three more participants noticed the message(s). The remaining three Presenter participants did not notice the chat messages at all.

As we pointed out in the caveat at the beginning of section 3.2.3, these observations can be applied to regular BBB sessions only with limitations. We therefore refrain from interpreting these observations as symptoms of a usability problem.

3.2.3.2 Shared Notes

3.2.3.2.1 Writing

7/7 participants were able to write to the shared notes without any difficulties.

3.2.3.2.2 Export

7/7 participants were able to export the shared notes to a PDF file without any difficulties.
We noticed that the name of the button reads "Import/export from/to different file formats", while importing seems to not be implemented as a functionality. We would hence propose renaming this button to "Export".

3.2.3.2.3 Noticing changes

Only one of the six Presenter participants whose performance we can compare with respect to this functionality quickly noticed changes in the shared notes. Four others noticed the changes when they opened the user list panel in order to be able to solve a later task. The remaining participant (P10) did not open the shared notes even when she was made aware of the notifications in the user list panel (there were notifications for both the chat and the shared notes, she responded only to the chat notification).

For contextualization of these observations, see the caveat at the beginning of section 3.2.3. We thus once more refrain from inferring the existence of a usability problem here.

3.2.3.3 Status

3.2.3.3.1 Setting one's status

3/3 participants were able to set their status without any difficulties.

3.2.3.3.2 Noticing others' status

Two participants expressed that they found status changes to be barely noticeable. Perhaps a solution could be to offer notifications for status changes in the notifications settings. Some of the ideas discussed in GitHub issue #13720 could also alleviate this problem.

3.2.3.4 Raised hands

3.2.3.4.1 Raising one's hand

3/3 participants were able to raise their hand without any difficulties.

3.2.3.4.2 Noticing and lowering others' raised hands

7/7 participants immediately noticed when a hand was raised. However, three of them were then unsure how to proceed. Two of those three thought the blue hand symbol in the top left of the notification box was a clickable button. None of the participants lowered the raised hand via clicking the user's icon in the top right of the notification box.

We would suggest to display a separate notification for each raised hand, which only has one button for lowering this specific hand. (In order to still be able to lower all hands with a single click, a corresponding button could be shown below the most recent raised hand notification.) We think that this avoids at least some of the confusion, and also help to more clearly visualize the queue.
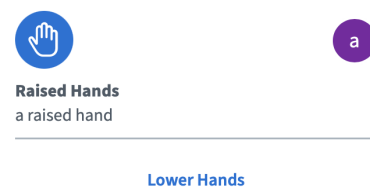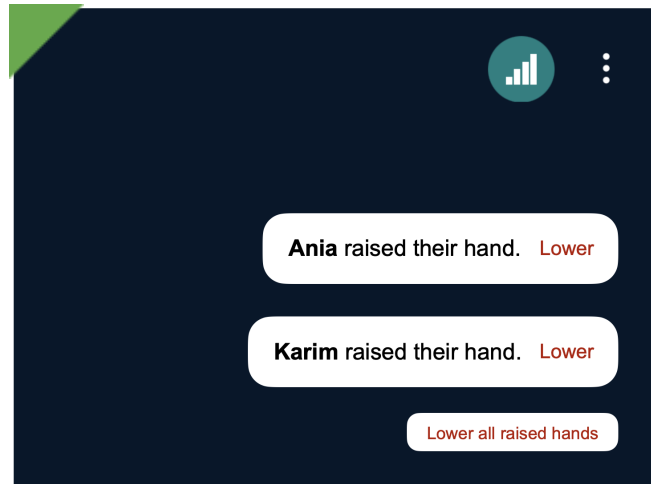
Our proposal for raised hand notifications when viewers' microphones are not locked.

In case viewers are locked and thus unable to activate their microphone, the raised hand notification could be extended by an "unlock microphone" button, a click on which would allow the participant who raised their hand to activate their microphone.
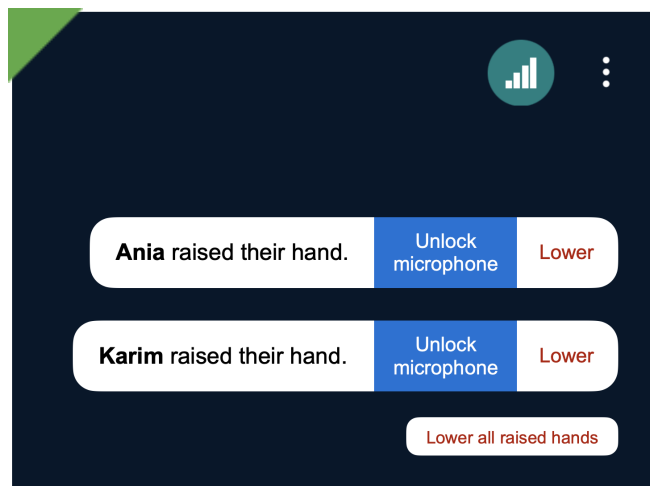
An additional "Unlock microphone" button for locked users

When the presenter clicks "unlock microphone", a button for both lowering the viewer's hand and reimposing the muting could appear.
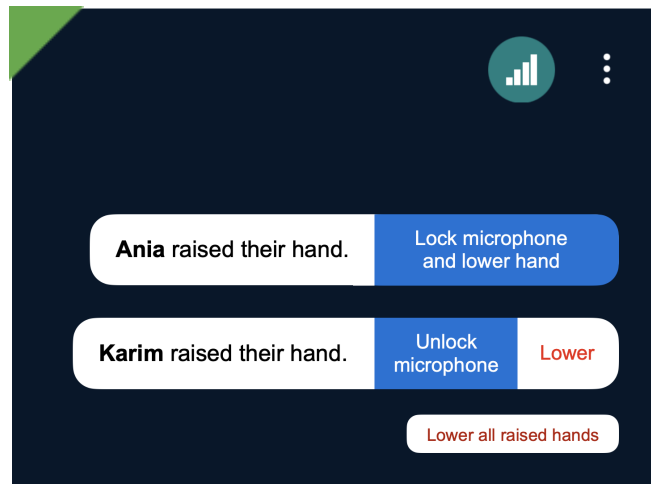
When Ania has finished talking, the presenter can lock her microphone and lower her hand with just one click.

We also considered the alternative of just having the "unlock microphone" button say "lock microphone" instead, such that two clicks would be required for locking the microphone and lowering the hand, but we think that this visual change might not be substantial enough for the presenter to notice.

3.2.4 Layout Manipulation

3.2.4.1 Moving webcam windows

3/6 participants were able to move the webcams without any difficulties, even though two of them had never done this before. Of the remaining three, one (P10) took two minutes to find out that they could move the webcams by dragging them. The other two participants figured this out much more quickly, but then took more than a minute to understand that they had to pull them into one of the four rectangles which appear when clicking on and holding the webcams.

Currently, when clicking and holding a webcam, three things happen in the UI:
➔ all webcams get grayed out
➔ the slides do not get grayed out
➔ transparent rectangle overlays appear on all four sides of the presentation area
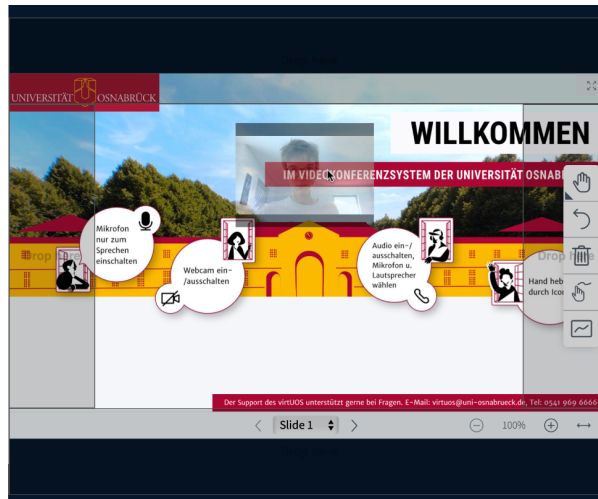
The four target rectangles in BBB 2.4

We would propose to enhance the visibility of the target rectangles, perhaps by displaying the target areas separately from the slides and using visual elements with a higher contrast, such as a hatching. Additionally, we would suggest:

➔ not graying out the webcams, as they are the object which the user is acting upon at this moment, and

➔ shrinking the slides and graying them out, as they are not the object which the user is acting upon at this moment.

Here is a sketch of what we imagined:
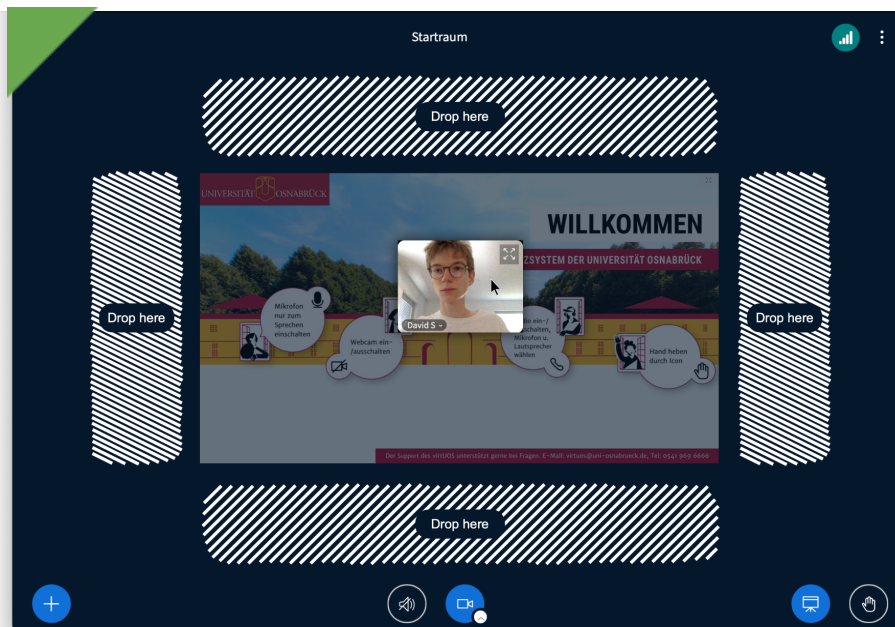
One way in which the perceptibility of the target rectangles could be improved

It is debatable whether P10's performance in this task implies a need for also improving the detectability of the drag-and-drop affordance – given that four out of five test participants

who did not know about this affordance immediately discovered it, we would say that the current design is sufficient in this respect.

3.2.4.2 Hiding the user list panel

3.2.4.2.1 Observations

2/6 participants (P1 and P5, who both had more than one year of experience in BBB) were able to hide the user list panel without any difficulties. The other 4 participants all searched the user list panel first before clicking the "User list toggle" button.

We would interpret this latter observation as pointing to the participants' assumption that it would be possible to hide the user list panel independently of the chat or shared notes panel. But in BBB 2.4, 2.5, and 2.6, this is not implemented: One can only see the chat or the shared notes panel when also the user list panel is shown.

The user list panel takes up a significant amount of space which is not required for some (if not most) of the tasks it enables, and most meeting participants do not require it during the entire session, while many do want to keep up with the chat. Meanwhile, a good portion of (potential) BBB users, especially students, are limited to relatively small displays, which particularly rely on space-efficient design. Hence, we would propose allowing users to hide the user list panel without concomitantly hiding the chat / shared notes panel.[3]

To offer an intermediate option as a compromise between space efficiency on one hand and being able to quickly perform actions such as switching between the chat and shared notes panel on the other, we would additionally suggest making it possible to minimize the user list panel. This latter option would already free up a considerable amount of space, which students could use to see more of their notes or increase the size of the slides:

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[3] There is an option to manually resize the width of the user list panel, but this is not a suitable solution because 1) it requires moving the cursor directly on the border between the user list panel and the chat / shared notes panel and then drawing it all the way to the left, which is cumbersome, and 2) the result does not look tidy.
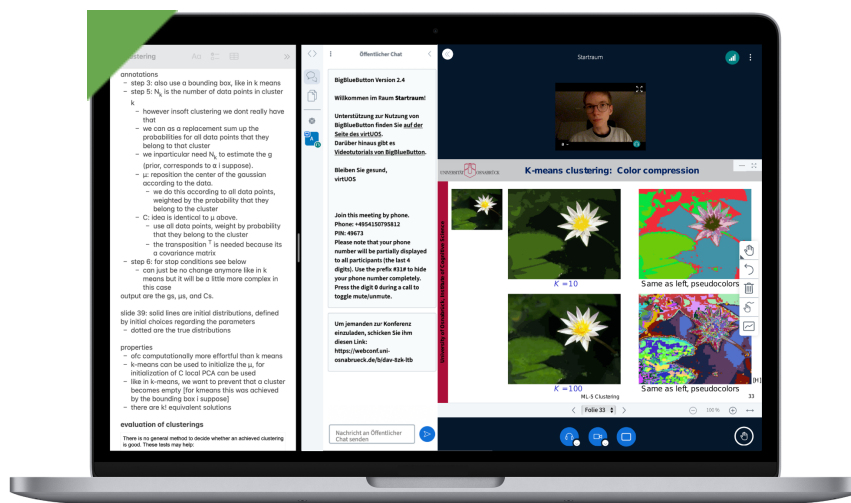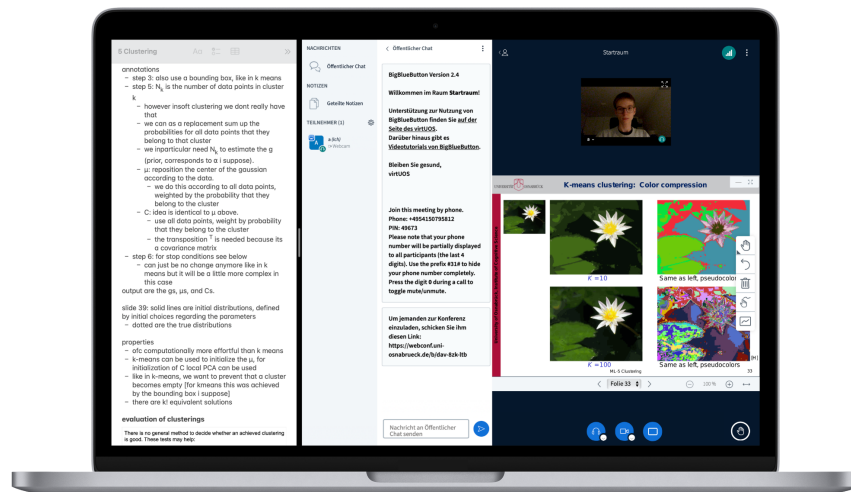
Comparison between an expanded (top) and minimized (bottom) user list panel on a relatively small display, together with notes (respectively on the left)

3.2.4.2.2 Corresponding Buttons

To integrate these functionalities, we propose the following button designs.

Firstly, since the "User list toggle" button does not only hide the user list panel, but also the chat / shared notes panel (and as P10 misinterpreted the current "User list toggle" button twice – she clicked it when she was trying to take the presenter role, and a second time as she was trying to leave the meeting), we would recommend a redesign showing e.g. two arrows (on a white ground for improved visibility).

Secondly, the buttons for hiding the user list panel and the chat / shared notes panel should be displayed consistently on the right of the respective panel, as this is where buttons for collapsing something to the left are usually placed:
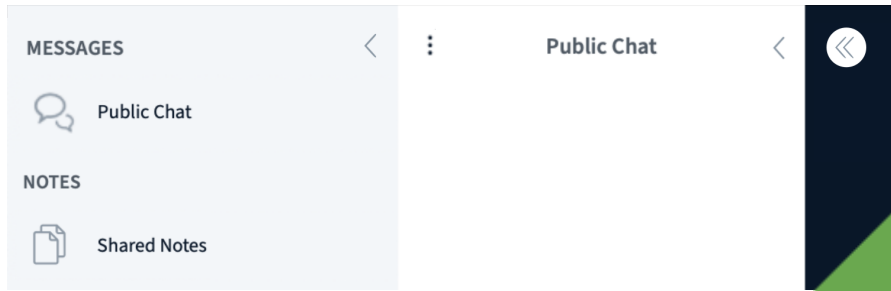
If the user list panel is minimized, there could be two buttons at the top: One for hiding the user list panel, and one for folding it out:
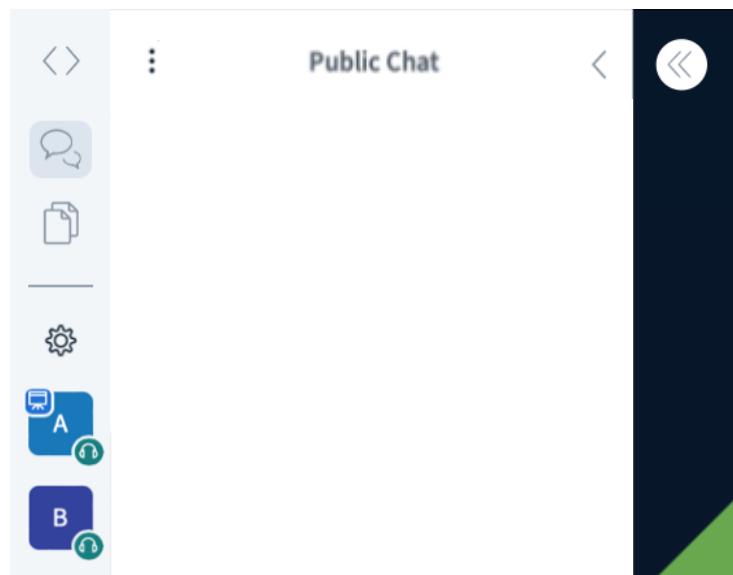
For hiding the user list panel while the chat panel is displayed / hidden, we would suggest an arrow on a blue ground for improved visibility and differentiation:
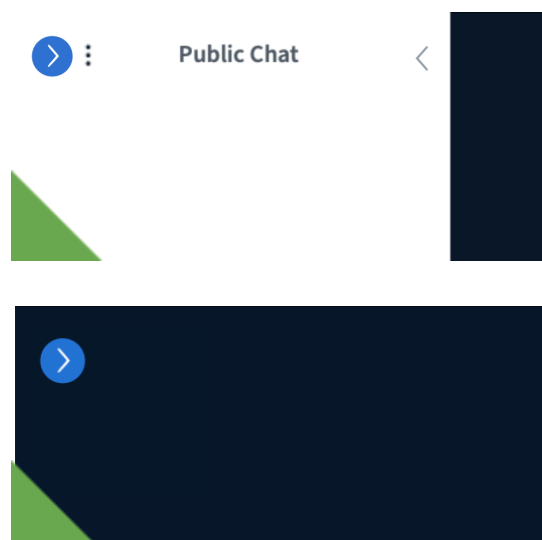
3.2.4.3 Layout types

We have to confess that we misunderstood this functionality when we prepared the test: We gave participants the task to push their layout to all other users, while this wasn't possible in BBB 2.4. What we expected them to do in order to achieve this was select "Custom (push layout to all)" in the "Layout type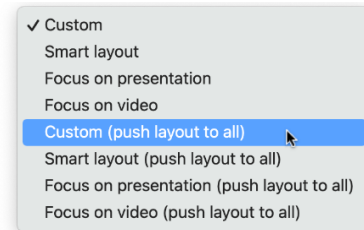" menu (see the image on the right). As we later noticed, this would only enable all users to manually reposition the webcam windows. However, we still made some observations that we think are quite interesting:

Only one of five participants whose performance we can compare regarding this functionality found the "Layout type" menu in the "Application" settings on their own, after 1 minute and 20 seconds of searching. All four others needed hints to find this menu.

While searching, 4/5 participants had a look at the user list panel before going into the settings or stated that they would have expected to find this functionality there. And when they had found the "Layout type" menu, 4/5 participants asked us what the options referred to.

With BBB 2.6, changes have been implemented which one may hope will prevent some of these problems: The "Layouts" menu has been relocated to the "Actions" button, and now comes with visualizations of the different options. But we want to think about the layout options a little more fundamentally here. Let us consider the layout options that are currently available one by one.

3.2.4.3.1 "Custom layout"

Users (including viewers) are always able to change their layout, no matter which layout is pushed to them. Therefore, no sharp line can be drawn between the "Custom" layout type and other layout types. The ability to modify one's layout should in our opinion not be represented as a separate layout type, but implemented as BBB's fundamental principle of layout manipulation – such that users don't always have to choose "Custom layout" in the layout settings in order to be able to modify a (potentially extrinsically imposed) layout.

3.2.4.3.2 "Focus on presentation"

We assume that the driving motivation for including this layout option was to offer a space-efficient solution for displaying the webcams to the side of the presentation while still being able to see the chat. But to us, it seems like implementing options for minimizing and hiding the user list panel while still displaying the chat (as proposed in section 3.2.4.2.1) would be a more elegant way to achieve this, especially considering that the webcams disappear as soon as one hides the chat or shared notes panel.

3.2.4.3.3 "Focus on video"

With the "Focus on video" layout type active, the presentation is so small that its contents can hardly be discerned. Making it more legible requires drawing the chat / shared notes panel to questionable widths and heights. To us, adjusting the relative size of the webcam videos and the presentation via the bar between the presentation area and the webcam videos without simultaneously reshaping the chat / shared notes panel seems much more intuitive. And as we explained above, flexibilizing the user list panel would in our opinion be a more straightforward option for improving space-efficiency.

3.2.4.3.4 "Smart layout"

If the "Focus on presentation" and "Focus on video" layout types are removed, there is no need to incorporate "Smart layout" as a layout type. We think it would be more reasonable then to integrate this functionality as a checkbox setting (we pick up on this in section 3.2.4.3.6) which is activated by default. Manually repositioning the webcam videos (without having to select "Custom layout" in advance, as described above) could disable this setting, while according to our intuition, adjusting the relative size of the webcam video positioning should not.

3.2.4.3.5 Summary

We suggest to remove the "custom" layout type while allowing users to directly modify their layout at all times, also when a layout has been extrinsically imposed on them. When functionalities for hiding and minimizing the user list panel independently of the chat have been implemented, the "Focus on presentation" and "Focus on video" layout options are obsolete. And at the latest when these two layout types have been removed, it would be more straightforward to integrate "Smart layout" as a checkbox option in the appearance settings.

3.2.4.3.6 Additional redesign proposal: "Appearance" settings

Currently, options which are associated with appearance are distributed across different areas of the UI: Options regarding font size and animations can be found in the "Application" settings, layouts can be propagated and layout types can be chosen via the "Actions" menu, and if our proposals in section 3.2.1.4.3 are accepted, the data savings menu will also hold options which affect the appearance of BBB.

We would suggest to provide these options in a separate "Appearance" menu, which may be placed in the settings and/or in the main screen. In the main screen, it could be handy to be able to access this menu via a button shown in the user list panel (which is where our participants tended to expect such options, see the beginning of section 3.2.4.3), in the icon bar below the presentation area (perhaps next to the "minimize presentation" button), or in the "options" menu in the top right corner of the main screen. The following sketch shows what the appearance menu could look like when shown in the user list panel.
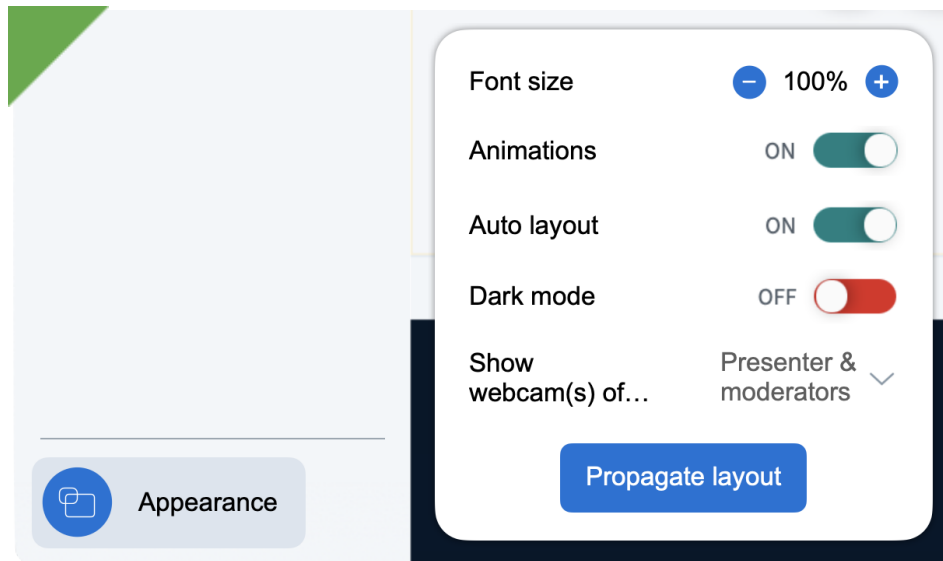
When we first presented these findings, we received feedback that selecting to display only a specific subset of the webcams should not be limited to the data savings options – hence, we included this functionality also in the "Appearance" options.

3.3 Missing Functionalities

Our participants were very content with the variety of functionalities offered in BBB, and could not think of functionalities that are missing – except for P2, who said that she missed an option to individually adjust the loudness of meeting participants. At BBB World 2022, it was discussed whether it could be possible to implement this as a functionality for the presenter.

3.4 Positive Remarks

Test participants appreciated the large variety of useful functionalities, the reliability and overall quality of central conferencing functionalities, and the shared notes feature. One participant also noted that they found the public and private chats to be easier to distinguish than in other conferencing applications.

4 Conclusion

Testing the BigBlueButton functionalities that are often used in seminars showed that there is room for improvement, particularly with respect to advanced presenter functionalities.
In order to make BigBlueButton's complete range of functionalities easily accessible to all users, regardless of prior experience in the application, we sketched sectional redesigns of BigBlueButton's user interface.
We will add our findings to the "Issues" section on BBB's GitHub presence in the coming weeks. The proposed changes will be evaluated with frequent BBB users this fall. We will report the thus obtained results in the corresponding GitHub issues.

5 Contact

In case of questions regarding this report, you can write an email to dsiecke@uos.de.

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7 Appendix

A) Presenter Task Sheet (translated from German)

Presenter Participant

Imagine you are giving a presentation for one of your seminars. Your seminar takes place online in BigBlueButton. Please work through the tasks listed below step by step, while describing your actions in your own words. Before you start working on a task, please briefly state what the task demands from you.

During the presentation, other students will be present in the conference and may indicate that they have a question or ask questions in various ways. Watch for and respond to the questions.

1. Join the BigBlueButton conference so that other participants can hear you.
2. Take on the role of the presenter and open your PDF presentation ("Demo.pdf" on the desktop) in BigBlueButton.
3. Hide the user list tab so you can focus on your presentation.
4. Arrange the other participants' webcams to the side of the presentation.
5. Ensure that all other participants also see the webcams to the side of the presentation.
6. You notice that your internet connection is getting weaker. Make sure that the other participants can still reliably understand you by reducing your data consumption.
7. Complete the task on slide 3 of the presentation. [*Connect two points on the slide*]
8. Afterwards, delete the solution from the slides.
9. Instruct the other participants to complete the task on slide 3 as well. Make sure that this is possible.
10. Remove the other participants' ability to draw on the slides.
11. Create a yes/no poll to find out if they liked the previous task. When all participants have voted, present the results.
12. You forgot to include a diagram in your presentation. Open the image file ("Diagram.png" on the desktop) and share your screen to show the diagram to the audience.
13. We are nearing the end of the seminar: Quit sharing your screen and then close the presentation so that the opening screen [*default.pdf*] is visible again.
14. Mute yourself and then mute all other participants.
15. Reset the statuses of the participants.
16. Save the shared notes to your desktop so you can access them after the seminar.
17. Leave the BigBlueButton meeting.

B) Viewer Task Sheet (translated from German)

Viewer Participant

Imagine that in one of your seminars a presentation is being held. The seminar takes place online in BigBlueButton. You participate as a viewer and attentively follow the presentation. Complete the following tasks. If the presenter gives you a task, you have to complete it as well.

1. Join the BigBlueButton conference so that other participants can see and hear you.
2. Make sure your webcam does not show your surroundings. To achieve this, switch to a virtual background.
3. Without the presenter noticing, ask the other participant about his or her course of study.
4. Raise your hand in BigBlueButton. When you are called on, choose any means of communication to tell the presenter that you think the slides are pretty.
5. When the presenter asks you and the other participants to perform a task, write in the shared notes that you would like to hear the task again.
6. When the results of the survey are published, write in the chat what you think about them.
7. Additionally, express your feelings about them with a corresponding smiley in the user list.
8. When the presentation is over, leave the conference.