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Abstract

This paper presents an oTree addon that allows to include face-to-face communication in the form of a video chat in online group experiments. Group decisions, as opposed to individual decision-making, have recently gained considerable attention. The open-source addon is easy to use, exhibits a lean design, and allows to record communication patterns. It has already been successfully employed in a number of group experiments. We explain how to implement the addon and provide a number of recommendations for smooth functionality.

JEL-Codes: C880, C920.

Keywords: group decisions, video chat, online experiments, experimental software, oTree.

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1 Introduction

This paper presents an easy-to-use tool that allows to include face-to-face communication in online group experiments in economics.

In recent years, online experiments have become ubiquitous which might be due to several reasons. For example, online experiments allow researchers to draw from considerably larger subject pools compared to pool sizes usually available in the lab. Moreover, alternative and/or more representative samples are available compared to those drawn from the pools of university labs that are mostly comprised of students. Recruitment platforms such as *Prolific* or *Amazon Mechanical Turk* contain thousands of possible participants from many countries and with various socio-economic and cultural backgrounds.¹ Finally, during the COVID-19 pandemic, many experimental labs were closed for experiments with physical presence of subjects. This has lead researchers to explore and hone the alternative of conducting their experiments online.

From a technical perspective, the scope of running online experiments has been enhanced by the emergence of *oTree* (Chen, Schonger, and Wickens, 2016), a novel and more flexible tool than *z-Tree*, the pioneer software for experimental economics.² *oTree* is an open-source software that can be used for both lab and online experiments, in the field and in classrooms, and with desktop and mobile devices.

The availability of *oTree* has also considerably enlarged the set of research questions that can be addressed with online experiments. The main reason is the augmented scope of interaction between remote participants, i.e when playing a game or when acting as a group.³ From a logistical point of view, implementing group experiments in the lab with physical presence of participants is often more challenging compared to an online setting, in particular for larger groups. Moreover, since the pandemic, for many of us online interaction with others has become an everyday routine task, e.g. as part of by now ubiquitous work-from-home arrangements.⁴

In interactive designs such as group experiments, researchers often wish to allow for communication between participants. In computerized lab experiments, written communication is relatively easy to implement, e.g. by allowing text messages to be exchanged between participants. Even free-form, face-to-face communication is possible when the respective participants are physically located in the same room (for a survey of communication in lab experiments, see e.g. Brandts, Cooper, and Rott, 2019). By contrast, in online experiments, only text messaging has so far been easy to implement.

¹For example, for their online experiment on effort provision, DellaVigna and Pope (2018) recruited more than 12,000 participants for a total of 18 treatments on *Amazon Mechanical Turk*.

²In experimental economics, for many years the seminal software *z-Tree* (Fischbacher, 1999, 2007) has been used by researchers at universities and other research institutions all over the world to conduct lab experiments.

³For example, there exists by now a sizeable economic literature studying group decisions involving cognitive, judgmental, or strategic tasks (for surveys, see e.g. Charness and Sutter, 2012; Kugler, Kausel, and Kocher, 2012).

⁴In the global survey of Aksoy, Barrero, Bloom, Davis, Dolls, and Zarate (2022), conducted in mid 2021 and early 2022, the average number of work days from home per week is 1.6 in the U.S., 1.8 in Germany, and 2.0 in the UK.

Against this background, we have developed *chaTree*, an addon for *oTree* that enables face-to-face communication within groups of subjects in online experiments in the form of a video chat. The aim of this paper is to explain to interested readers the basic features of the tool and to provide information on how to use it in their own research.

So far, we have employed *chaTree* successfully in several online experiments for varying chat group sizes, ranging from two to five members. Promann (2024) considers groups as decision-makers in asymmetric contests and studies within-group coordination. Muehlheusser, Promann, Roider, and Wallmeier (2024) and Muehlheusser, Roider, Vannozzi, and Wallmeier (2025) consider the impact of group size and group composition in the domains of unethical behavior (lying) and solving non-routine, complex team tasks, respectively. Also in the context of unethical behavior, Dato, Feess, Mayer, Muehlheusser, and Nieken (2025) study the effect of information versus communication in groups.⁵ In these four experiments, more than 3,000 participants have successfully interacted using *chaTree*.

2 Features of *chaTree*

The addon *chaTree* has the following key features: First, it is easy to use. For the experimenter, integrating it into *oTree* code is straightforward. Also, subjects do not need to install software on their devices. They are just asked by their browser to grant access to their microphone and camera. Moreover, subjects do not have to pick usernames, which are predetermined by the experimenter.

Second, *chaTree* exhibits a lean design. As illustrated in Figure 1 (taken from Muehlheusser, Promann, Roider, and Wallmeier, 2024), the video chat can be directly embedded in an experimental screen. Also, the user interface of the video chat is plain, allowing each participant to fully focus on the experimental instructions and the other group members in the chat.

Third, *chaTree* itself does not impose a restriction on the number of participants in any given video chat. A certain limitation arises from the fact that, within a given group chat, every incoming and outgoing video stream is hosted by each participant's device, so that the video chat's performance decreases with the number of participants. Thereby, the worst-performing participating device provides an upper bound on the number of participants that can interact smoothly in the chat.

Finally, *chaTree* logs the audio levels of participants' microphones. This data allows to recover communication patterns in the chat (e.g. the number and duration of individual talking spells of participants, or the total number of spells in a chat).⁶ Currently, the programming of *chaTree* is such that neither the audio nor the video content of the chat is recorded.

⁵In all of these papers, subjects were recruited using the platform *Prolific*. In Promann (2024), part of the online experiment was conducted via the lab of the University of Hamburg, employing its subject pool.

⁶For example, Muehlheusser, Promann, Roider, and Wallmeier (2024) study whether communication patterns are gender-specific.


Figure 1: An example for the use of *chaTree* in an online group experiment

Task 1: Group Page


Time left to complete this page: **9:45**

VIDEO CHAT

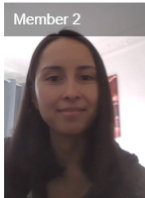
Member 4




Member 1



Member 2



Member 3



TASK DESCRIPTION: PLEASE READ IT NOW

- When the counter in the video **CLIP** has reached zero, all members of your group will see the same clip that shows the roll of a standard die. Each of the six possible numbers is equally likely.
- The die roll will be displayed for 10 seconds, and the task of your group is to memorize it.
- You can use the **VIDEO CHAT** to discuss the die roll within your group.
- As for payoffs, if not all group members report the same number within the time limit of 10 minutes, then every group member gets a payoff of 0. If all group members report the same number, then every group member gets a payoff as stated in the following table:

Number reported by all group members	1	2	3	4	5	6
Payoff for each group member (in £)	0.50	1.00	1.50	2.00	2.50	0

- Practically, each group member makes an individual entry in the **DECISION WINDOW**. Entries may be adjusted at any time, and the decision window displays the most recent entry of each member. When all members have entered the same number, the group report will be locked in, resulting in the payoffs according to the above table.

CLIP

02:45

DECISION WINDOW

You are group member 4

Enter/update your report and then press "Submit":

Once identical numbers have been entered by all group members and the group report has been locked in, click on any of the two circles below and then press "Next" to proceed.

☐ ☐

Next

Group member	1	2	3	4
Number currently entered				

Identical numbers entered by all group members: **NO**

Note: The screenshot is taken from Muehlheusser, Promann, Roider, and Wallmeier (2024). Within the decision screen, participants can use the video chat to discuss a group decision that they need to take jointly.

3 Implementation

Integrating the *chaTree* add-on into an *oTree* project requires a basic understanding of *oTree*. The source code and the README file explaining how to proceed are provided on *GitHub*.⁷ The provided code also enables the collection of audio log data.

The current version of the code for implementing the video chat requires a Video API account at *Vonage* (the video chat provider) and a *Mongo DB* account to host a database for temporary data storage. The README file provides guidance on how to set up the *Vonage* API and *Mongo DB* accounts, and it points to necessary adjustments relating to user-specific login information for these accounts. The primary use of the database is to store identification keys of video chat participants. This way, a group that is matched within *oTree* will also be allocated to the same video chat room, while the next group is allocated to a separate video chat room. In addition to the identification keys, only the participants' audio log data are stored in the database. The identification keys consist of various letters and integers in random order, while the audio log data consist of individual participants' voice levels (normalized to values between 0 and 1), which are saved every 0.5 seconds. No private information of participants is stored externally, and *chaTree* obeys with current data privacy protocols. Currently, creating a *Vonage* API account entails 2,000 minutes of free video chat time and once this is depleted a charge of 0.00381 Euro per participant per minute. *Mongo DB* currently offers a free version with limited database storage capacity. However, as the data volume stored is relatively small (and if the database is emptied after each session), the free version will likely be sufficient.⁸

As discussed above, the server used for the *oTree* experiment will not bear the main load of computing capacity as every incoming and outgoing video stream is hosted by each participant's device. Nevertheless, the data traffic will reach higher levels compared to a regular online experiment, so that using a reasonably small session size is recommended. For example, Muehlheusser, Promann, Roider, and Wallmeier (2024) have smoothly conducted sessions with around 50 participants that were simultaneously interacting in separate video chats.⁹

Group experiments are relatively costly as the unit of observation is typically a whole group (instead of an individual). Avoiding group breakdowns that result from technical issues experienced by one or more group members therefore seems desirable (because such breakdowns will typically trigger payments of show-up fees without generating a group observation). For this reason, it is recommended to check (and ensure) sufficient functionality of experimental subjects' video and audio devices already before groups are formed. For example, Muehlheusser, Promann, Roider, and Wallmeier (2024) proceeded as follows (for details, see their Section 3.2). First, agree-

⁷See <https://github.com/TimoPromann/chaTree>. The code is provided for *oTree*5. Application in an *oTree*3 environment is also possible and requires only minor adaptations.

⁸We recommend to check the functionality of the Video API and the database before each experimental session.

⁹When the video chat server's capacity is insufficient, some video chats will not run properly. Similarly, when the server hosting the experiment has insufficient capacity, some pages will load only very slowly (especially when live pages are included).

ing to use their camera and microphone was a prerequisite for participation in the study. Second, on the welcome screen of the experiment, participants were informed that they would be interacting with other participants in a video chat. They actively had to consent to this and had to confirm that their cameras and microphones were operational. Third, each participant individually had to perform a functionality test of their camera and microphone, and only participants who successfully completed this test were allowed to continue.¹⁰ Fourth, after this step, groups were formed, and group members had to perform another video and audio test at the group level. In particular, on the respective experimental screen each group member had to confirm that they could see and hear all other group members. Only after all group members had done this, groups were allowed to proceed to the actual experimental group task.¹¹

4 Conclusion

This paper presents *chaTree*, an *oTree* addon, which allows to integrate video chat functionality in online experiments. We explain its features and implementation, and we hope that interested researchers will perceive *chaTree* as a potentially useful tool.

¹⁰Within the experiment, participants were asked to click on a link that redirected them to the external website of a provider of free video and audio tests (see <https://tokbox.com/developer/tools/precalls/results>). This website automatically checks the functionality and transmission quality of the respective user's camera and microphone, rating them on scores ranging from 0 to 4.5. This takes between 10 and 20 seconds. Subjects were asked to report these scores, and they were allowed to proceed with the experiment only if the reported scores were at least 2.5 each.

¹¹As a consequence of these functionality checks, the drop-out rate is likely to be higher than in standard *oTree* experiments. Hence, we recommend a higher safety margin of free *oTree* slots than usual as well as intensive testing with a variety of devices, browsers, and operating systems.

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