Economics Letters 252 (2025) 112349

Contents lists available at ScienceDirect

Economics Letters

journal homepage: www.elsevier.com/locate/ecolet

chaTree: An oTree addon allowing face-to-face communication in online group experiments

Timo Promann [a], Jan-Patrick Mayer [a], Gerd Muehlheusser [a,b,c], Andreas Roider [b,c,d,e,*], Eugen Tereschenko [f], Niklas Wallmeier [g]

[a] University of Hamburg, Department of Economics, Von-Melle-Park 5, D-20146 Hamburg, Germany
[b] IZA, Germany
[c] CESifo, Germany
[d] University of Regensburg, Department of Economics, Universitätsstraße 31, D-93053, Regensburg, Germany
[e] CEPR, France
[f] Calypso Commodities, Franz-Mayer Straße 1, D-93053 Regensburg, Germany
[g] arq decisions GmbH, Nobistor 16, D-22767 Hamburg, Germany

ARTICLE INFO

JEL classification:
C88
C92

Keywords:
Group decisions
Video chat
Online experiments
Experimental software
oTree

ABSTRACT

For online group experiments, we present an oTree addon that allows to include face-to-face communication in the form of a video chat. The addon is easy to use, exhibits a lean design, and allows to record communication patterns.

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 et al., 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

* Corresponding author at: University of Regensburg, Department of Economics, Universitätsstraße 31, D-93053, Regensburg, Germany.
E-mail addresses: timo.promann@uni-hamburg.de (T. Promann), jan-patrick.mayer@uni-hamburg.de (J.-P. Mayer), gerd.muehlheusser@uni-hamburg.de (G. Muehlheusser), andreas.roider@ur.de (A. Roider), et@calypso-commodities.com (E. Tereschenko), niklas.wallmeier@gmail.com (N. Wallmeier).

[1] For 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*.

[2] In 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.

[3] For 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 et al., 2012).

https://doi.org/10.1016/j.econlet.2025.112349
Received 29 March 2025; Received in revised form 16 April 2025; Accepted 17 April 2025
Available online 1 May 2025
0165-1765/© 2025 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/).

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 et al., 2019). By contrast, in online experiments, only text messaging has so far been easy to implement.

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 et al. (2024) and Muehlheusser et al. (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 et al. (2025) study the effect of information versus communication in groups.[5] In these four experiments, more than 3000 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 Fig. 1 (taken from Muehlheusser et al., 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.

3. Implementation

Integrating the *chaTree* addon 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 s. No private information of participants is stored externally, and *chaTree* complies with current data privacy protocols. Currently, creating a *Vonage* API account entails 2000 min 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 et al. (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 et al. (2024) and Promann (2024) proceeded as follows. First, agreeing 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

[4] In the global survey of Aksoy et al. (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.

[5] In 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.

[6] For example, Muehlheusser et al. (2024) study whether communication patterns are gender-specific.

[7] See 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.

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

[9] When 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).

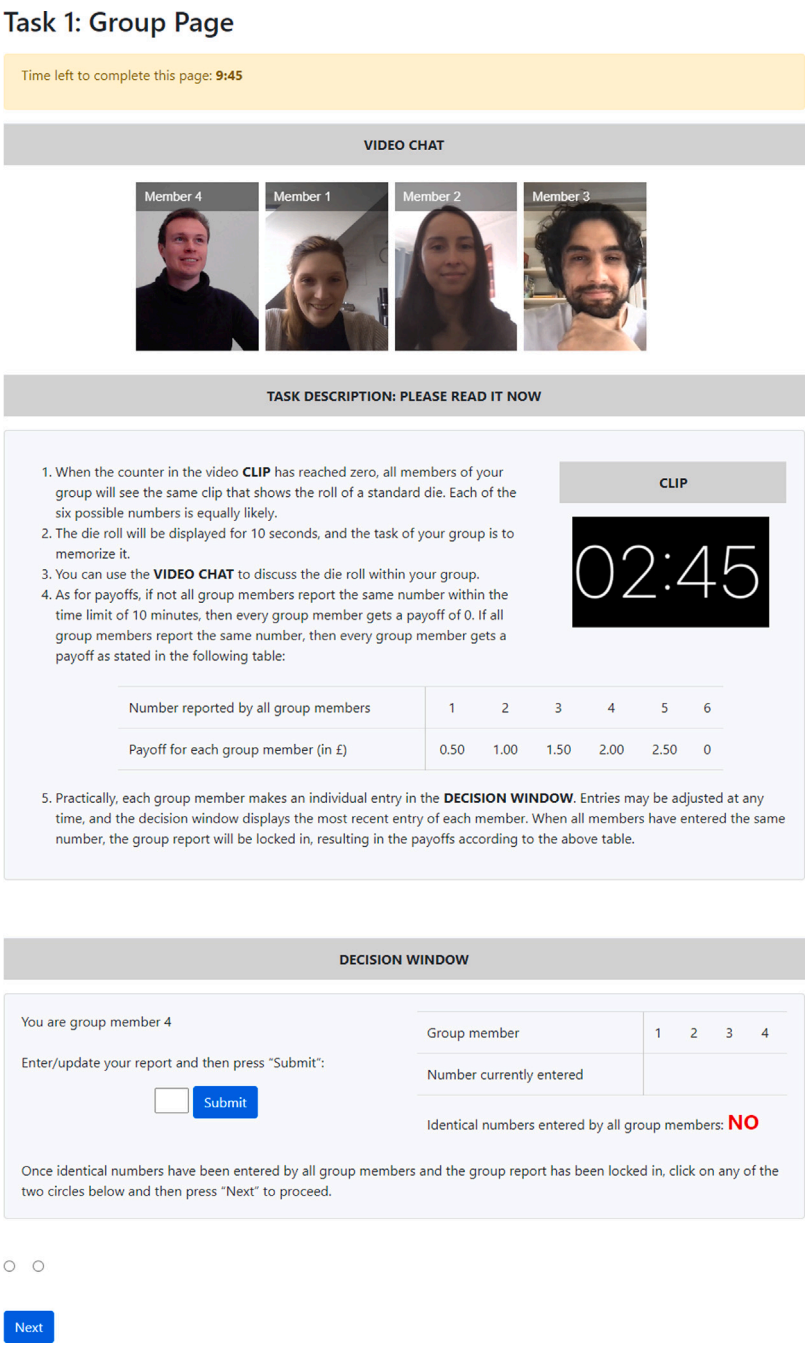

Fig. 1. An example for the use of *chaTree* in an online group experiment.
Note: The screenshot is taken from Muehlheusser et al. (2024). Within the decision screen, participants can use the video chat to discuss a group decision they need to take jointly.

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.

As a result of these functionality checks, drop-outs of participants occurred before the actual experimental group interaction started. In particular, in the setting of Promann (2024) with groups of two, 8.2 percent and 21.2 percent of participants dropped out because of reported technical issues at the individual functionality test and the group-level functionality test, respectively. Nevertheless, the costs of drop-outs due to the functionality checks were modest and accounted for only 8 percent of total payments in the experiment, because these participants only received a show-up fee. In Muehlheusser et al. (2024) who consider groups of up to five, the corresponding drop-out rates

[10] Within 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/precall/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 s. 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.

due to the functionality tests at the individual and group-level were 13.6 percent and 37.5 percent, respectively. In both Promann (2024) and Muehlheusser et al. (2024), the higher drop-out rates at the group-level functionality test were also driven by the feature that all group members were dropped as soon as at least one member reported technical issues at this stage.[11] Overall, we recommend a higher safety margin of free *oTree* slots than in standard online experiments as well as extensive testing with a variety of devices, browsers, and operating systems.

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.

Acknowledgments

An earlier version of this note was circulated as CESifo Working Paper No. 11734. We gratefully acknowledge financial support by the German Research Foundation (DFG, Grant 658143 and Research Training Group 2503/1 "Collective Decision-Making"). We are very grateful to Riccardo Vannozzi, Jonas Radbruch, and Philipp Kisters for valuable comments and suggestions, and we thank Berthold Wahjudi, Nina Wagner, and Mey-Ling Sommer for their support when testing *chaTree*.

Data availability

No data was used for the research described in the article.

References

Aksoy, C.G., Barrero, J.M., Bloom, N., Davis, S.J., Dolls, M., Zarate, P., 2022. Working from home around the world. Brookings Pap. Econ. Act. 2022 (2), 281–360.

Brandts, J., Cooper, D., Rott, C., 2019. Communication in laboratory experiments. In: Schram, A., Ule, A. (Eds.), Handbook of Research Methods and Applications in Experimental Economics. Edward Elgar Publishing, pp. 401–418.

Charness, G., Sutter, M., 2012. Groups make better self-interested decisions. J. Econ. Perspect. 26 (3), 157–176.

Chen, D.L., Schonger, M., Wickens, C., 2016. oTree – an open-source platform for laboratory, online, and field experiments. J. Behav. Exp. Financ. 9, 88–97.

Dato, S., Feess, E., Mayer, J.-P., Muehlheusser, G., Nieken, P., 2025. Unethical decisions by groups: The role of information and communication. Manuscript in preparation.

DellaVigna, S., Pope, D., 2018. What motivates effort? Evidence and expert forecasts. Rev. Econ. Stud. 85 (2), 1029–1069.

Fischbacher, U., 1999. Z-tree: A toolbox for readymade economic experiments. University of Zurich, IEW Working paper 21.

Fischbacher, U., 2007. z-Tree: Zurich toolbox for ready-made economic experiments. Exp. Econ. 10, 171–178.

Kugler, T., Kausel, E., Kocher, M., 2012. Are groups more rational than individuals? A review of interactive decision making in groups. Wiley Interdiscip. Rev.: Cogn. Sci. 3 (4), 471–482.

Muehlheusser, G., Promann, T., Roider, A., Wallmeier, N., 2024. Honesty of groups: Effects of size and gender composition. IZA Discussion Paper No. 16954.

Muehlheusser, G., Roider, A., Vannozzi, R., Wallmeier, N., 2025. Groups performing complex tasks: The role of group size and group composition. Manuscript in preparation.

Promann, T., 2024. Unfair contests — Experimental evidence for individuals and teams. SSRN Working Paper No. 5035753.

[11] In alternative experimental designs, group members not experiencing technical issues could potentially be matched to functional groups such that drop-outs are reduced.