BORN-OPEN DATA FOR JSPSYCH

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Running head: BornOpen4jsPsych

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Abstract

Born-Open Data is a framework whereby experiments are conceived from the start as making the data openly accessible. This framework was first described in Rouder, 2016, and an actual implementation for E-Prime 2.10 was provided by Cousineau, 2020. Herein, we provide an implementation for jsPsych. It consist in a plugin for jsPsych which can be inserted anywhere in the experiment's timeline and a function called upon completion of the experiment. The data are then uploaded transparently and automatically to a GitHub repository where they are immediately and openly accessible to the research community.

Keywords: Born-Open data; open-access data; repositories;

Born-Open Data for jsPsych

Introduction

Born-Open Data is an approach whereby experiments are designed and programmed in a way that the data are directly accessible to the research community. The process must be as direct as possible (no filters) and as transparent as possible. First proposed by Rouder in 2016, it stems from open science initiatives meant to promote better scientific practices (e.g., Simmons et al., 2011). One implementation for E-Prime was described in Cousineau (2020) and used in Maxcey, Shiffrin, Cousineau and Atkinson (submitted).

To be useful, an implementation must be easy to use. An ideal implementation should consist of one or a few commands added to the script of an experiment, from which everything else is done transparently. Further, it should be easy to disable these commands (placing them as comments in the script) while performing tests and de-commenting them when beta testing is completed without impact on the rest of the script.

Herein, we describe an implementation for jsPsych experiments. This implementation was prompted by the COVID pandemic. Prior to this, our experiments were run in a laboratory setting, with computers that were specifically configured to handle experiments. With the advent of the pandemic, many experiments were moved to an online environment running on personal computers which may not have specialized software. This added a level of complexity to the present endeavor. Indeed, the two

previous implementations of Born-Open data used GitHub as the container (the *repository*) and `git` as the protocol to interact with the container (Chacon & Straub, 2014). However, whereas it is very easy to install `git` on a laboratory computer, we cannot expect that it will be present on a participant's computer. Therefore, all repository manipulations are now performed by a server, a computer accessible through the web.

We chose `jsPsych` as the platform for programming the experiments because it was specifically created for that purpose and is openly and freely accessible (de Leew, 2015). It is also fairly easy to program experiments with this platform (which extends JavaScript capabilities with dedicated functions called *plugins*), and the developers' team provides timely support. Bridges et al. (2020), among others, have documented the measurement precision of `jsPsych` and other online programming environments for psychology experiment with respect to collecting response times and presenting visual stimuli. At the time of this writing, `jsPsych` version 6.1 was used, but a version 7 is scheduled to be released soon.

In what follows, we present the plugin `BornOpen4jsPsych-Initialize` and an accompanying function that triggers the upload of the data. Next, we describe the general process underlying the plugin. The interested reader can try a dummy experiment located at tqmp.org/BornOpen4jsPsych/testExperiment/ (URL are case-sensitive). The participant ID "e1W2q1" (case-sensitive as well) is allowed to run session 1 indefinitely. The responses collected are transferred to the following repository github.com/VIC-Laboratory-ExperimentalData/Test in the folder called `rawdata` within seconds.

The plugin

The *BornOpen4jsPsych* plugin is contained in a JavaScript file called `BornOpen4jsPsych-Initialize.js`. This file must be placed in the folder where the experiment resides (typically, the experiment is contained in an HTML page). Inside the experiment, the following lines of code are needed to load the plugin and its style sheet:

```
<!-- declaring the BornOpen4jsPsych plugin -->
<script src='https://ajax.googleapis.com/ajax/libs/jquery/2.2.4/jquery.min.js'>
</script>
<script src="BornOpen4jsPsych-Initialize.js"></script>

<!-- uploading the style sheet -->
<link href="BornOpen4jsPsych.css" rel="stylesheet" type="text/css"></link>
```

Because the *BornOpen4jsPsych* plugin requires extensions, these must be loaded as well (the *jquery* extensions, available from Google).

In the experiment's timeline, an event must be inserted which initializes the *BornOpen4jsPsych* capabilities. The simplest description of the event is:

```
// the initialization of BornOpen4jsPsych
var InitializeBornOpen = {
  type:      'BornOpen4jsPsych-Initialize',
  experiment: 'Test',
  server:    'https://tqmp.org/BornOpen4jsPsych'
}
```

This event results in a slide being shown in the experiment; a screen captures is seen in Figure 1. This event is contained in a variable, here named `InitializeBornOpen` (the name is arbitrary). It has the following attributes:

- `type`: a mandatory *jsPsych* attribute describing the plugin to be used. Here the name `BornOpen4jsPsych-Initialize` corresponds to the JavaScript file

containing the description of the plugin, `BornOpen4jsPsych-Initialize.js`.

- `experiment`: This mandatory attribute defines the name of the experiment. The experiment must be defined on that server (see below). Here, the experiment is called `Test` (case sensitive).
- `server`: This mandatory attribute indicates which server (along with any path if needed) holds the relevant server-side programs to process the born-open data requests.

In addition to these mandatory information, two optional attributes can be provided:

- `session`: If the experiment is composed of a single session, it is possible to fix the session number within the event, with, for example, `session : "1"`. If a session identifier is given, that information will not be requested from the "Identification" slide shown in Figure 1.
- `subject`: Likewise, if it is not necessary to have an identifier for each participant. It is possible to pre-specify a single subject ID in the initialization (or fetch the subject ID from other means).

When both subject and session are pre-specified, the "Identification" slide is not shown at all.

This step will initialize interval variables. It will also verify that this subject ID is allowed to perform that session ID by consulting a list of invited participants on the

server. If not found in the invitations, the button "Begin the experiment" remains disabled and the experiment cannot proceed any further.

Triggering the upload

The above slide allows a participant to continue the experiment. However, it does not trigger the upload of the data. To that end, it is necessary to call the function called `BornOpen4jsPsychSave` (made available when the plugin is loaded). This function can be used anywhere, although the best time is upon completion of experiment, using the *on_finish* trigger of the `jsPsych.init()` main function. For example, the following inserted into the `jsPsych.init()` will trigger an upload of all the data collected in the experiment:

```
on_finish: function() {  
    BornOpen4jsPsychSave( jsPsych.data.get().json() );  
}
```

The "`get().json()`" method of the `jsPsych.data` collects all the data into a *JavaScript Object Notation* format (the only format accepted by `BornOpen4jsPsych`). Note that all the data are collected, including the time to respond to the welcome screen. If desired, it is possible to filter the data and save only that subset of data. Unless you are familiar with filtering in `jsPsych`, I would recommend saving all the data and filtering at the data analysis stage.

The process behind BornOpen4jsPsych

The events triggered by BornOpen4jsPsych can be subdivided into two stages, the first stage occurring when the initialization plugin is called, the second when the upload function is called. The whole process is schematized in Figure 2.

When initialization is performed:

The experiment name, subject ID and session ID are sent over the web on the server specified in the plugin. There, a PHP program receives that information through a POST protocol and determines whether that experiment exists. The experiment exists if there is a subfolder of that name. Next, within that subfolder, it consults a file called `_invitations.txt` to see if the duo subject ID/session ID is present and can still run that session. If that session has already been run, a "done" indication is found next to the pair of information. If the participant is allowed to run that session, an indication `once`, a number of remaining runs or `inf` (standing for infinite) is found in the file.

The code for this program is available on github.com/dcousin3/BornOpenData4jsPsych, in the file `_checkExperimentSubjectSession.php`.

For the Test experiment accompanying this text, the file `_invitations.txt` is accessible through the URL obtained by concatenating the server, the experiment's name and `_invitations.txt`, separated with slashes, e.g., for the current demo:

https://tgmp.org/BornOpen4jsPsych/Test/_invitations.txt

In this demo, a single participant is allowed to run session 1 an infinite amount of times.

The email address will be used on the second stage.

When the participant's subject and session IDs are valid, the button "Begin the experiment" is enabled and the participant can complete the subsequent events in the timeline.

When uploading is performed:

When the function `BornOpen4jsPsychSave` is called, the data are sent over to the server along with the subject and session ID, as initialized by the plugin. There, the server, through a PHP program (available as `_saveExperimentSubjectSession.php` on github.com/dcousin3/BornOpenData4jsPsych) will consult in the experiment's folder a file called `_owner.txt`. This file contains the experimenter's name and email (on distinct lines). It also contains the GitHub repository and its owner. You can consult the `_owner.txt` file for the present illustration by concatenating the server's location, experiment name, and `"_owner.txt"`, i.e.:

https://tgmp.org/BornOpen4jsPsych/Test/_owner.txt

With this information, it will add the current data file into the repository found at

<https://github.com/OWNER/REPOSITORY>

under a folder called "rawdata". In the present illustration, this represents

<https://github.com/VIC-Laboratory-ExperimentalData/Test>

The credentials for logging into GitHub must be stored on the server, typically with a Secured Shell (SSH) protocol (see `git` and `ssh` documentations). The user whose credentials are kept on the server does not have to be the owner/creator of the repository but must have the relevant privileges to clone and push data on that repository.

Each data file will be named by concatenating the experiment's name, subject ID, session ID, separated by a dash (and a character string starting with "b" if that subject completed that session more than once). The file will be saved as a comma-separated text file, a format accessible to all software/programming languages.

If a file `subjectsLog.txt` is found in the repository, an additional line with the participant's ID, session ID, date and time will be appended at the end of that file.

It then sends an email to the experimenter (containing a copy of the data) as well as acknowledge of reception to the participant (whose email was in the fourth column of the file `_invitations.txt`). Consequently, any time you test the present application, the owner (denis.cousineau@uottawa; that is, me) and the participant (denis.cousineau@yopmail.com, a password-free email account) will receive an email.

Finally, a copy of the data file is also kept on the server. Although this is not necessary (the owner receives a copy by email and there is a copy on GitHub), I chose not to remove it for extra security. If you have limited disk space on your server, consider removing these extra copies from time to time.

Prerequisite

In sum, to implement this BornOpen4jsPsych protocol, you need, regarding the jsPsych experiment, to

- 1- copy the file `BornOpen4jsPsych.js` and `BornOpen4jsPsych.css` where your experiment's HTML file is located (it can be on the web or on local files);
- 2- in the experiment, add a `BornOpen4jsPsych-Initialize` event early in your timeline and a call to the function `BornOpen4jsPsychSave` at the end;

On a server to which you have access, you need to

- 3- copy the two PHP scripts which run stage-one and stage-two processes (namely `_checkExperimentSubjectSession.php` and `_saveExperimentSubjectSession.php`; both are available on github.com/dcousin3/BornOpenData4jsPsych);
- 4- on that server, for each experiment you want to run, create a subfolder with the experiment's name and store in this folder the invitations and owner's information (file `_invitations.txt` and `_owner.txt`). I chose to proceed with IDs stored in an invitation file to control who runs the experiment and how many times they can run it.

These last two files are presently openly accessible to anyone who knows where to direct a browser. It is possible to have them inaccessible to the public by adding to the server's `.htaccess` file the following line

```
Options All -Indexes
```

With this line, any folder where a file with the name `index.html` cannot be found will be forbidden (error 403: access denied). Other solutions are also possible to hide files on a server.

The reader will also find on github.com/dcousin3/BornOpenData4jsPsych an archive file (`testExperiment.zip`) which contains the demonstration experiment with all its accompanying files located at <https://tqmp.org/BornOpen4jsPsych/testExperiment/>

Conclusion

I chose to develop the BornOpen4jsPsych system around an invitation list. That choice was made to control who can run the experiment. Without the proper subject ID/session ID pair, the experiment cannot be run. In addition, is it possible to control the number of times a participant can re-run the experiment (from a single access, to multiple access, or even infinite access). This control is necessary in experiments whose focus is on training effects.

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Figure Captions

Figure 1. Slide triggered by the `InitializeBornOpen` event.

Identification

Enter your subject Id:

Enter you session number:

No response yet

Figure 2. Overview of the process underlying BornOpen4jsPsych.