FACULTY OF ECONOMICS AND BUSINESS ADMINISTRATION

WORKSHOP ON THE USE OF 'IMPLICIT MEASURES' IN SOCIAL SCIENCES

Slabbinck & Spruyt / VUB WORKSHOP / DAY-1 (15-09-2023)

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SESSION 2: ADDITIONAL SELECTION CRITERIA AND SOFTWARE

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1. ADDITIONAL SELECTION CRITERIA

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ADDITIONAL SELECTION CRITERIA

- Relative vs. non-relative measures
- Administration: offline vs online
- Ease of data aggregation
- Completion time
- Ease of implementation

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RELATIVE VS. NON-RELATIVE MEASURES

Tasks that capitalize on R-SRC effects yield relative measures only

- The IAT is an example of such a task.
- Other implicit measures (e.g., EPP, AMP, or PEP) can yield relative as well as non-relative scores, depending on their exact implementation and score calculation.

Disadvantages of relative scores

- Unclear if the midpoint of the scale corresponds to the theoretical zero-point of the underlying concept. The debate is (still) going on!
- Equivocal interpretation: different scenario's can produce similar scores.

Example 1: Preference for Coca Cola over Pepsi Cola ...

• Coca Cola ++	vs.	Pepsi Cola +
• Coca Cola -	vs.	Pepsi Cola --
• Coca Cola +	vs.	Pepsi Cola -

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RELATIVE VS. NON-RELATIVE MEASURES

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- The IAT is an example of such a task.
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Disadvantages of relative scores

- Unclear if the midpoint of the scale corresponds to the theoretical zero-point of the underlying concept. The debate is (still) going on!
- Equivocal interpretation: different scenario's can produce similar scores.

Example 2: A marketing campaign improves the score of Coca Cola (relative to Pepsi Cola) ...

- Did the implicit attitude towards Coca Cola increase?
- Did the implicit attitude towards Pepsi Cola decrease?
- A combination of both?

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ADMINISTRATION

Digital vs. pencil-and-paper

- In principle, implicit measures require accurate reaction-time measurements (with the AMP being a notable exception).
- For that reason, they are typically administered via a computer, but paper-and-pencil alternatives do exist.
- Paper-and-pencil alternatives could be interesting to reach specific populations (e.g., elderly) or to handle specific research settings (e.g., a classroom).
- Psychometric properties of paper-and-pencil alternatives are hardly studied, so prudence is in order!

Examples

- AMP: stimuli are presented for one second (via a booklet or ppt); participants complete a printed form.
- IAT: next slide

ADMINISTRATION

FUMIE Test

Task 0																			
peace	satisfied	unhappy	danger	war	elected	defeat	happy	safety	dissatisfied	anxiety	savings	despair	eliminated	debt	merit	equal	victory	disease	clean
Task P-1																			
satisfied	TARGET	war	despair	best	TARGET	defeat	equal	TARGET	victory	TARGET	demerit	TARGET	anxiety	hope	TARGET	eliminated	merit	health	danger
Task N-1																			
best	unhappy	TARGET	discriminate	victory	TARGET	safety	TARGET	inferior	danger	TARGET	happy	TARGET	defeat	hope	satisfied	disease	TARGET	debt	TARGET
Task P-2																			
war	happy	TARGET	elected	TARGET	inferior	TARGET	unhappy	ease	TARGET	savings	eliminated	worst	health	TARGET	safety	disease	TARGET	best	TARGET
Task N-2																			
worst	TARGET	happy	dissatisfied	TARGET	ease	TARGET	disease	satisfied	savings	devil	TARGET	anxiety	TARGET	dirty	TARGET	peace	equal	TARGET	best
Task P-3																			
best	unhappy	TARGET	discriminate	victory	TARGET	safety	TARGET	inferior	danger	TARGET	happy	TARGET	defeat	hope	satisfied	disease	TARGET	debt	TARGET
Task N-3																			
satisfied	TARGET	war	despair	best	TARGET	defeat	equal	TARGET	victory	TARGET	demerit	TARGET	anxiety	hope	TARGET	eliminated	merit	health	danger
Task P-4																			
worst	TARGET	happy	dissatisfied	TARGET	ease	TARGET	disease	satisfied	savings	devil	TARGET	anxiety	TARGET	dirty	TARGET	peace	equal	TARGET	best
Task N-4																			
war	happy	TARGET	elected	TARGET	inferior	TARGET	unhappy	ease	TARGET	savings	eliminated	worst	health	TARGET	safety	disease	TARGET	best	TARGET
Task P-5																			
satisfied	TARGET	war	despair	best	TARGET	defeat	equal	TARGET	victory	TARGET	demerit	TARGET	anxiety	hope	TARGET	eliminated	merit	health	danger
Task N-5																			
best	unhappy	TARGET	discriminate	victory	TARGET	safety	TARGET	inferior	danger	TARGET	happy	TARGET	defeat	hope	satisfied	disease	TARGET	debt	TARGET
Task P-6																			
war	happy	TARGET	elected	TARGET	inferior	TARGET	unhappy	ease	TARGET	savings	eliminated	worst	health	TARGET	safety	disease	TARGET	best	TARGET
Task N-6																			
worst	TARGET	happy	dissatisfied	TARGET	ease	TARGET	disease	satisfied	savings	devil	TARGET	anxiety	TARGET	dirty	TARGET	peace	equal	TARGET	best
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

Mori et al. (2008)

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EASE OF DATA AGGREGATION

AMP

- Not a reaction-time measure
- Easy to convert raw data into meaningful outcome measures
- AMP score = proportion of positive responses (binary judgments) or mean score (Likert-scales)

EPT, IAT, PEP, IMPACT, …

- Reaction-time measures, which are heavily affected by (fast and slow) outliers.
- Handling RT data implies data-analytical skills … and often difficult decisions have to be made!
- Will be discussed in detail next week.
- Templates can be found online (but make sure you know what they are doing)

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EASE OF DATA AGGREGATION

Example for the IAT (see next week)

Algorithms for the IAT's *D* measure

Step	**Built-in error penalty procedure (preferred)** *Each trial's latency is recorded to occurrence of the trial's correct response; trials on which errors preceded the correct responses are included*	**Computed error penalty** *For IAT procedures that end a trial on the first keypress, recording the latency of that keypress and code the response as correct or error*
1	Designate combined tasks as A (for which faster performance will produce a positive score) and B (for which faster performance will produce a negative score). With counterbalancing, half of subjects will encounter A in Blocks 3 & 4, half in Blocks 6 & 7	Same
2	Discard all trials in Blocks 1, 2, and 5	Same
3	Identify blocks for combined task A as A1 and A2; those for combined task B as B1 and B2. If task A is Blocks 3 & 4, Block 3 is A1, Block 4 is A2	Same
4	Eliminate from remaining data (Blocks 3, 4, 6, and 7) *only* trials with latencies > 10,000 ms	Same
5	Eliminate all subjects for whom *more than* 10% of remaining trials have latencies faster than 300 ms	Same
6	Compute latency means (MnA1, MnA2, MnB1, MnB2) and SDs (SDA1, SDA2, SDB1, SDB2) for each of the four blocks for all remaining trials	Compute latency means for *correct responses* in each of the four blocks (separately) for remaining trials; also, replace each error response with a score computed as the *mean of correct responses in the same block as the error, plus a penalty* (see the note below this table)
7	Compute two mean latency differences: B1–A1 = (MnB1 – MnA1) and B2–A2 = (MnB2 – MnA2)	Compute the two mean latency differences from all trials, including the error trials that were replaced in Step 6 using error penalties
8	Compute an *inclusive* (not pooled) SD1 using all latencies in Blocks A1 & B1; another (SD2) using all latencies for A2 & B2 (SD2). These can be computed from means and SDs from Step 6 as shown in the lines below this table	Compute the two inclusive SDs using all trials (using the error trials with their replaced latencies)
9	Compute (B1–A1) / SD1; and (B2–A2) / SD2	Same
10	*D* = Average of two quotients computed in Step 9	Same

Greenwald et al. (2022)

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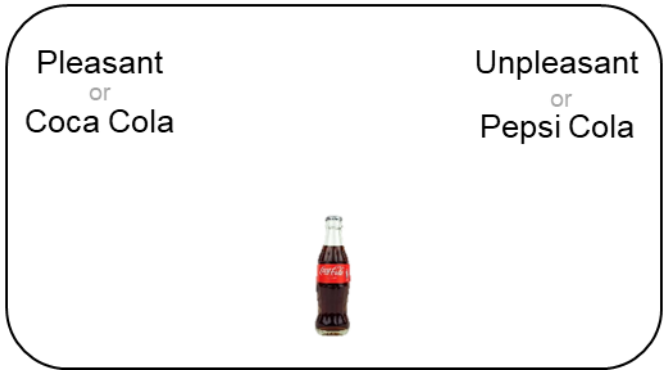
COMPLETION TIME

Most implicit measures require 5-15 minutes to complete

- A standard IAT often includes 280 trials (i.e., 40 trials per block x 7 blocks)
- For other tasks this is the same order of magnitude (i.e., between 100 – 300 trials)
- The PEP definitely takes the most time to complete (cf. word-by-word presentation of the primes)
- Shorter versions exist, but often with weaker psychometric properties
- The IMPACT is a step forward because it allows for the measurement of several appraisals simultaneously (instead of administering several IATs in a row)

The BRIEF IAT

Example of critical trial of traditional IAT



Example of critical trial of BRIEF IAT

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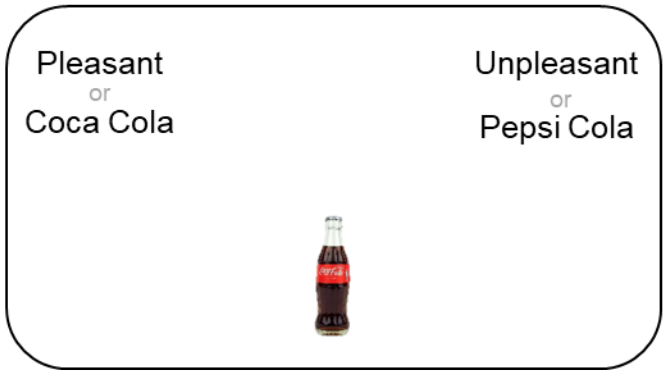
COMPLETION TIME

The BRIEF IAT

- Instructions: Press “E” for pleasant or Coca-Cola, press “I” for everything else.
- Up to 1/3 of trials ….
- But comparable psychometric properties?!

Example of critical trial of traditional IAT



Example of critical trial of BRIEF IAT

Sriram & Greenwald (2009)

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EASE OF IMPLEMENTATION

- Is a function of …
  - Procedural complexity (e.g., SSC < RRC)
  - Availability of stimulus materials (depends on topic)
  - Technical (programming) skills

- Often choice between user-friendliness versus customizability

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EASE OF IMPLEMENTATION

Software

GENERIC SOFTWARE	SaaS
Programming based • Inquisit (www.millisecond.com) • Expyriment (expyriment.org) • jsPsych (www.jspsych.org) • NBS Presentation • Psychophysics Toolbox **GUI based** • E-Prime • OpenSesame (osdoc.cogsci.nl) • PsychoPy (psychopy.org) • Lab.js (js.org)	• CognitionGate.com • Testable.org • CoolTool.com • Gorilla.sc

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EASE OF IMPLEMENTATION

Software

GENERIC SOFTWARE	SaaS

• **Requires scripting**
  ○ From scratch, or starting from adaptable templates
  ○ With (e.g., LabJS, Psychopy) or without (e.g., Inquisit, JsPsych) GUI
 	
• **Online vs offline data collection**
  ○ Some require 'translation' of programming language to allow online data collection (e.g., PsychoPy: Python script needs to be translated to JavaScript)
  ○ With or without integrated webhosting
  ○ Alternative hosts: Pavlovia, Qualtrics, JATOS
  ○ Some are free, other are paid
	• Click and play
	• Less flexible
	• Black-box
	• Paid service
	
	Our **advice**: invest in developing your programming skills (JavaScript and/or Python) and opt for **generic software**!

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EASE OF IMPLEMENTATION

Qualtrics

- https://iatgen.wordpress.com: An online tool to build (and analyze) a ready-to-run Qualtrics Survey File (QSF) containing a customized IAT.

- Qualtrics: can also be used as a host of other IMs that are build with JavaScript (e.g. LabJS: https://labjs.readthedocs.io/en/latest/learn/deploy/3a-qualtrics.html)

- Other and better web hosting services: Pavlovia & Open Lab (which can communicate with Qualtrics and most other survey software tools)

SUMMARY

Evaluation of the EPP, AMP, IAT, and PEP

Table 3. Overview of the Additional Features of the Selected Measures.

Ease of Implementation	EPT	AMP	IAT	PEP
		Depends on the Software Used		
Pencil-and-paper version available	−	+	+	−
Short completion time	−[a]	−[a]	−[a]	−
Easy data aggregation	−[b]	+	−[b]	−
Absolute outcome (vs relative)	+	+	−	+

Note. − No; + Yes.

[a]Shorter versions are available.

[b]Many software packages offer automated scoring routines or customizable aggregation scripts to convert raw data into measurement outcomes.

Slabbinck & Spruyt (2022)

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FINAL CONSIDERATIONS

Predictive validity

- Typically, the predictive validity of implicit measures is disappointingly low (but see next week).
- It is therefore difficult to recommend any measure based on this criterion.
- This is one of the most important challenges for the future.

User Experience

- Typically not taken into account by academic researchers.
- But poses an obstacle to practical use.
- The UX of existing implicit measures is generally low, but anecdotal evidence suggests that respondents prefer SSC and I-SRC tasks over R-SRC tasks and RRC tasks.

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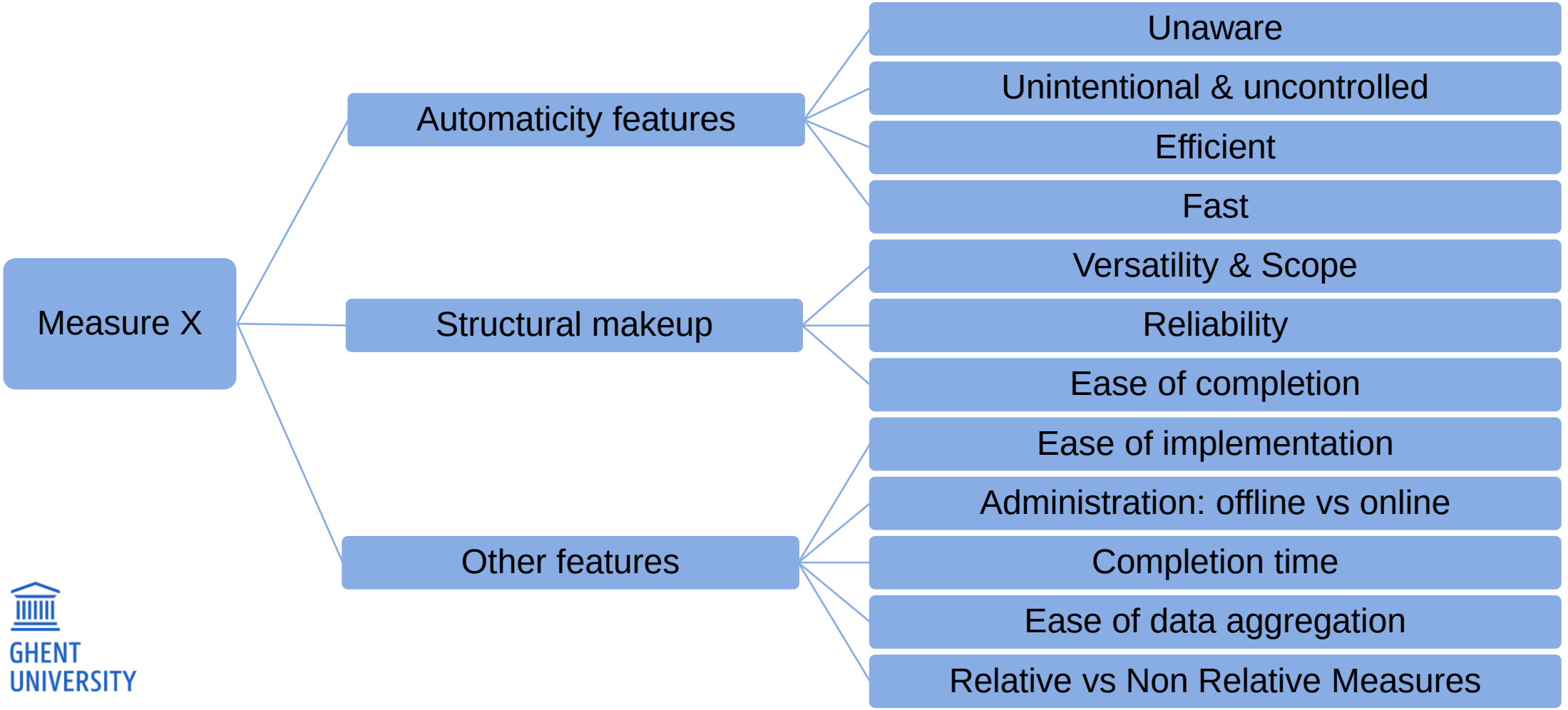
OVERVIEW // EXERCISE (?)

Prioritize *your* selection criteria and motivate your selection



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2. CRASH COURSE LABJS

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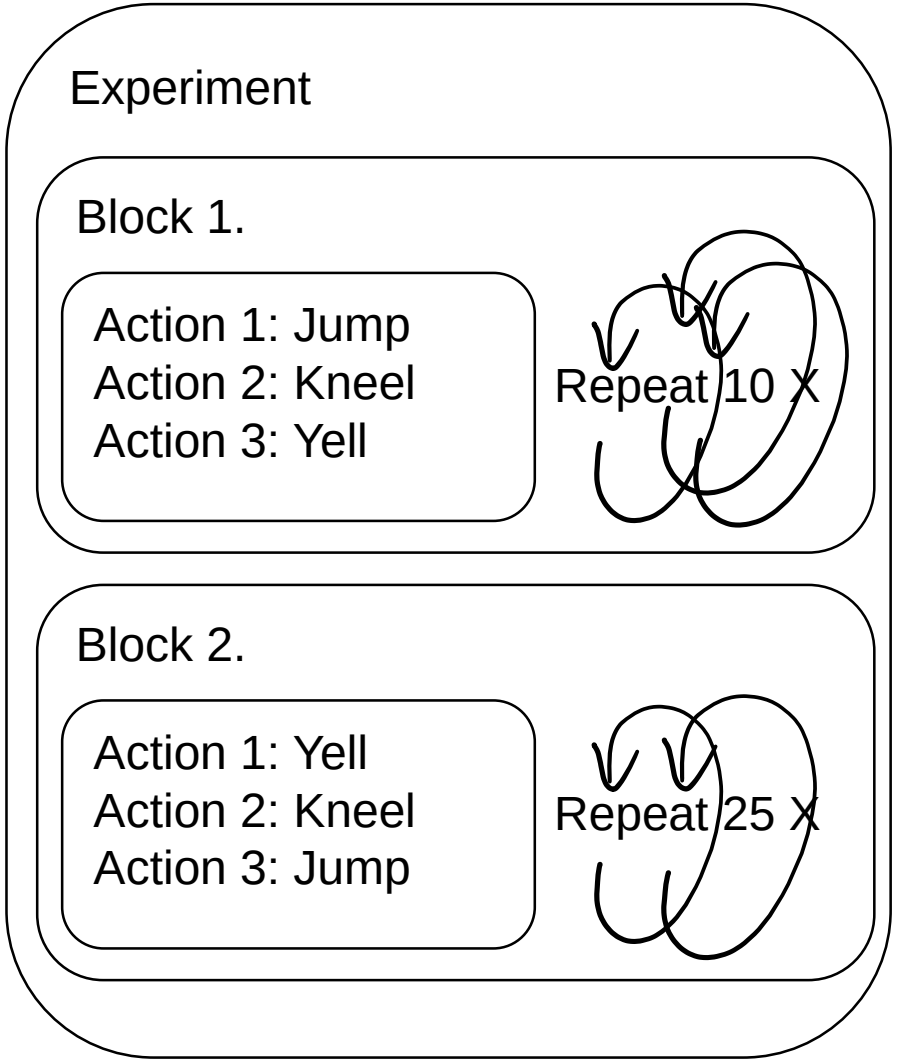
TYPICAL TERMINOLOGY

- An experiment consists of one or several tasks.
- Each task most often consists of a series of repetitive actions.
- In experimental psychology, a task is often referred to as a ‘block’ and the repeated actions is called a ‘trial’.



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SOFTWARE FOR EXPERIMENTAL RESEARCH

Something to build the experiment

Something to host the experiment

Stand Alone solutions (LabJS, PsychoPy, OpenSesame, …)

Stand alone solutions (browser, Jason, Pavlovia, Qualtrics, JATOS, …)

Integrated solutions (Inquisit, Gorilla, Cognition Gate, …)

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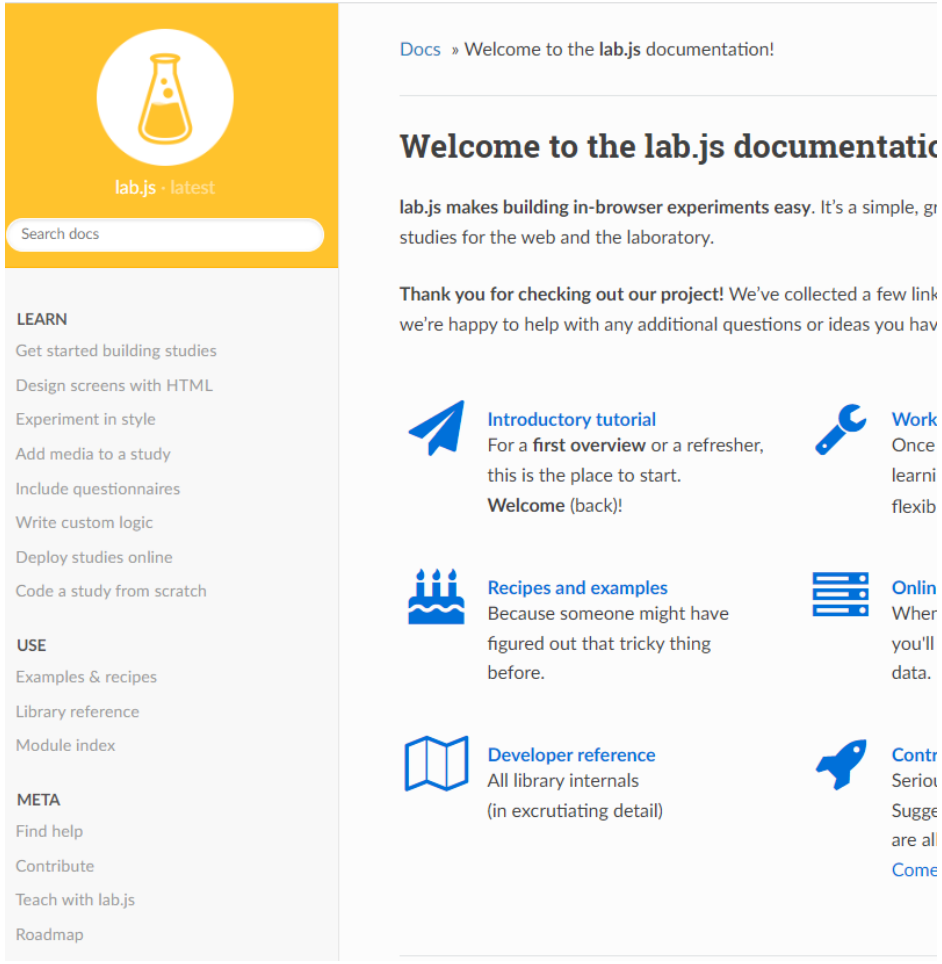
WHY LABJS?

- Free
- Intuitive
- Growing popularity
- Different ways to host experiment / collect online data
- Easy integration with Javascript
- Endless possibilities (thanks to Javascript)
- Lab.js comes with a well documented learning site https://labjs.readthedocs.io
- But … works best with Firefox and Chrome - may be unstable in other browsers (incl. Opera)



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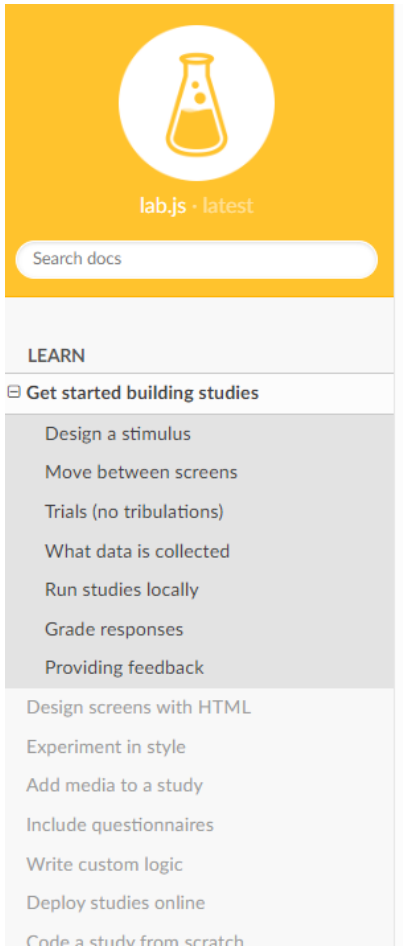
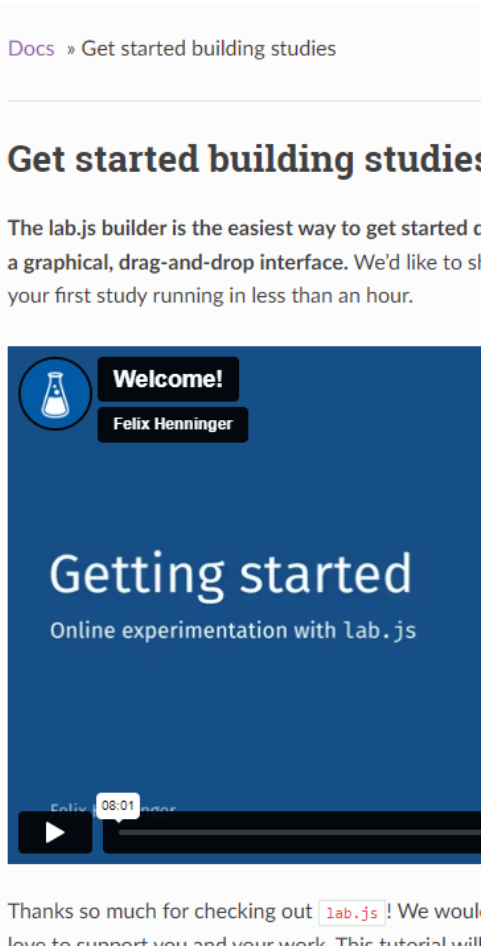
QUICK START?

- Especially the section entitled “Get started with building studies” (which includes instruction movies) is essential for a quick start.

- Other topics are useful / needed when you have higher demands (both in terms of lay-out and procedure).





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LEARNING BY DOING: BUILDING THE AMP

- First we build an (imperfect) AMP, using only the available options in the LabJS builder.
- Then we optimize our version with (simple) JavaScript coding.
- Next, after taking a look at the generated data, we examine additional possibilities to ‘upgrade’ the AMP procedure:
  - Solve the last ‘not really perfect details’ in the procedure by means of JavaScript (medium to hard)
  - Improve the layout by means of html coding (easy)

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THE AMP PROCEDURE

- The standard AMP only comprises one (experimental) block. A typical trial consist of the following actions (typical presentation duration in parentheses):
    - Presentation of a **prime** (75 to 1500 ms)
    - Presentation of a white screen (100 ms)
    - Presentation of a **target** (100 to 200 ms)
    - Presentation of a **Chinese ideograph** until a classification response is detected (e.g., pleasant vs. unpleasant)
- At least 100 trials are recommended (*).

(*) Payne, K., & Lundberg, K. (2014). The affect misattribution procedure: Ten years of evidence on reliability, validity, and mechanisms. Social and Personality Psychology Compass, 8(12), 672-686.

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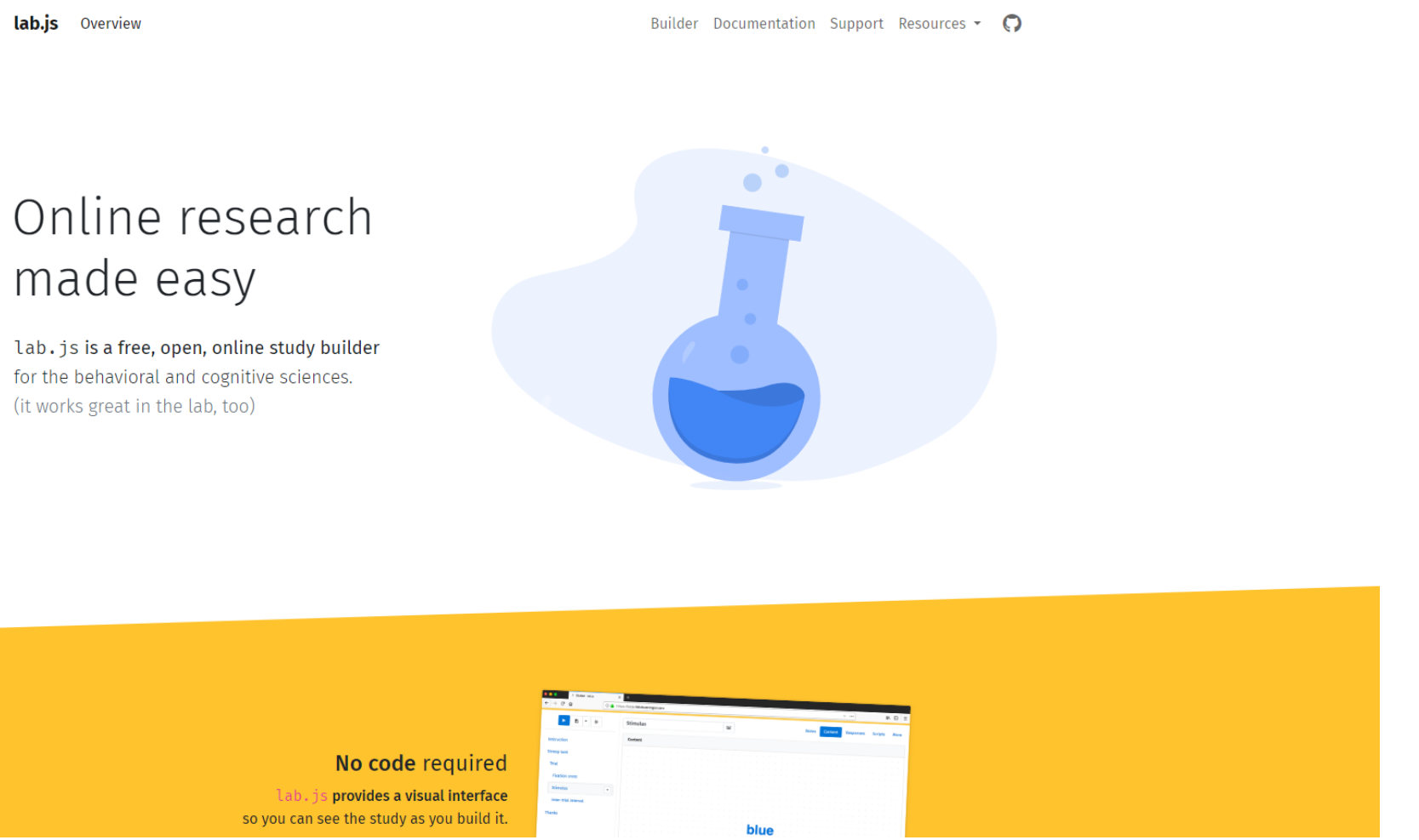
LAB.JS.ORG IS WHERE IT ALL BEGINS



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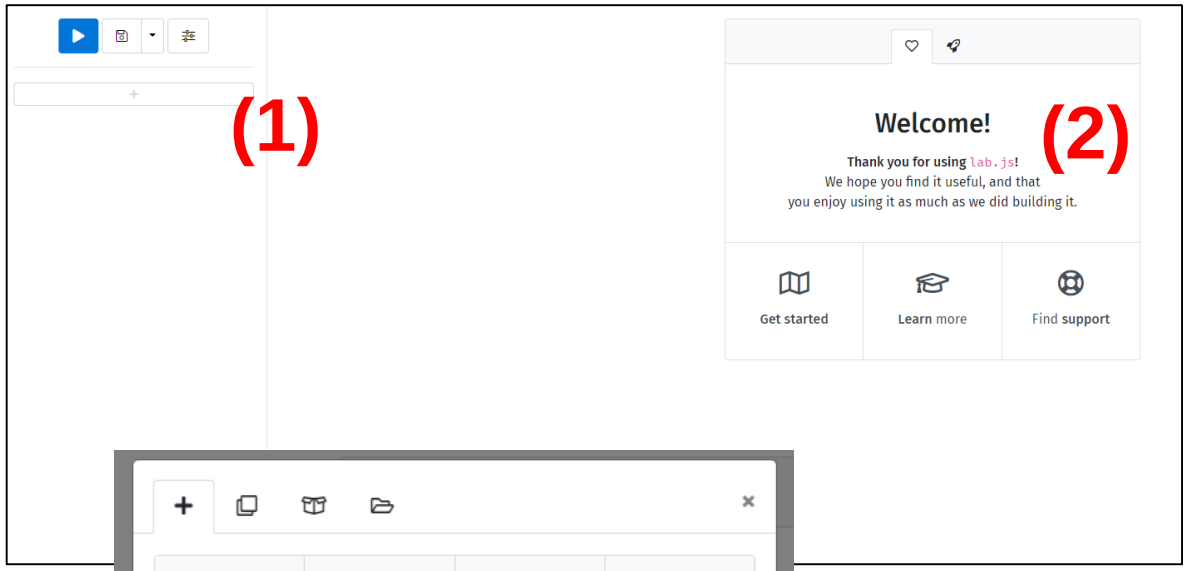
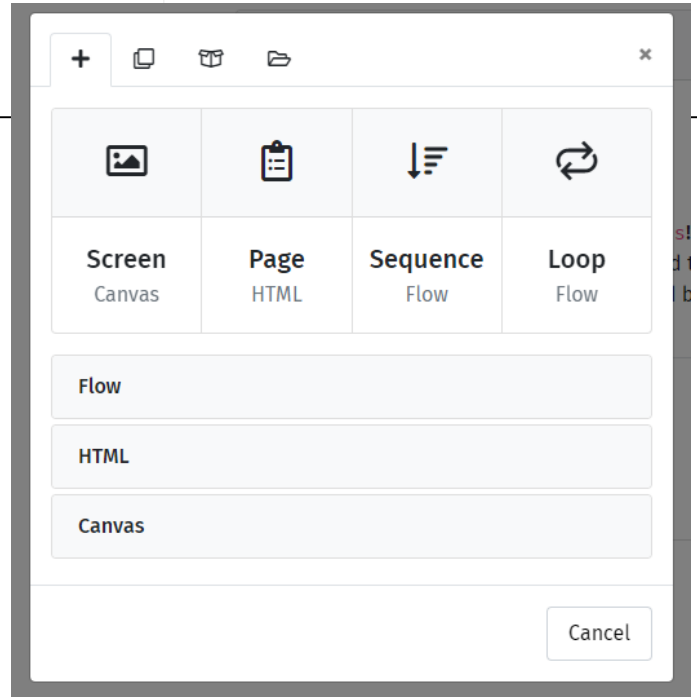
THE BUILDER

- To access the builder, navigate to https://labjs.felixhenninger.com
- You can start from scratch **(1)**, or from an existing template **(2)**. We start from scratch.
- The AMP starts with some instruction screens.
- So add your first ‘screen’





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EACH ELEMENT HAS ‘CONTENT’ & ‘BEHAVIOR’

- Add **‘content’** to your screen **(1)**, like text boxes, images, or any other object.
- Define the properties of each object **(2)**
- Give your screen a meaningful name **(3)**

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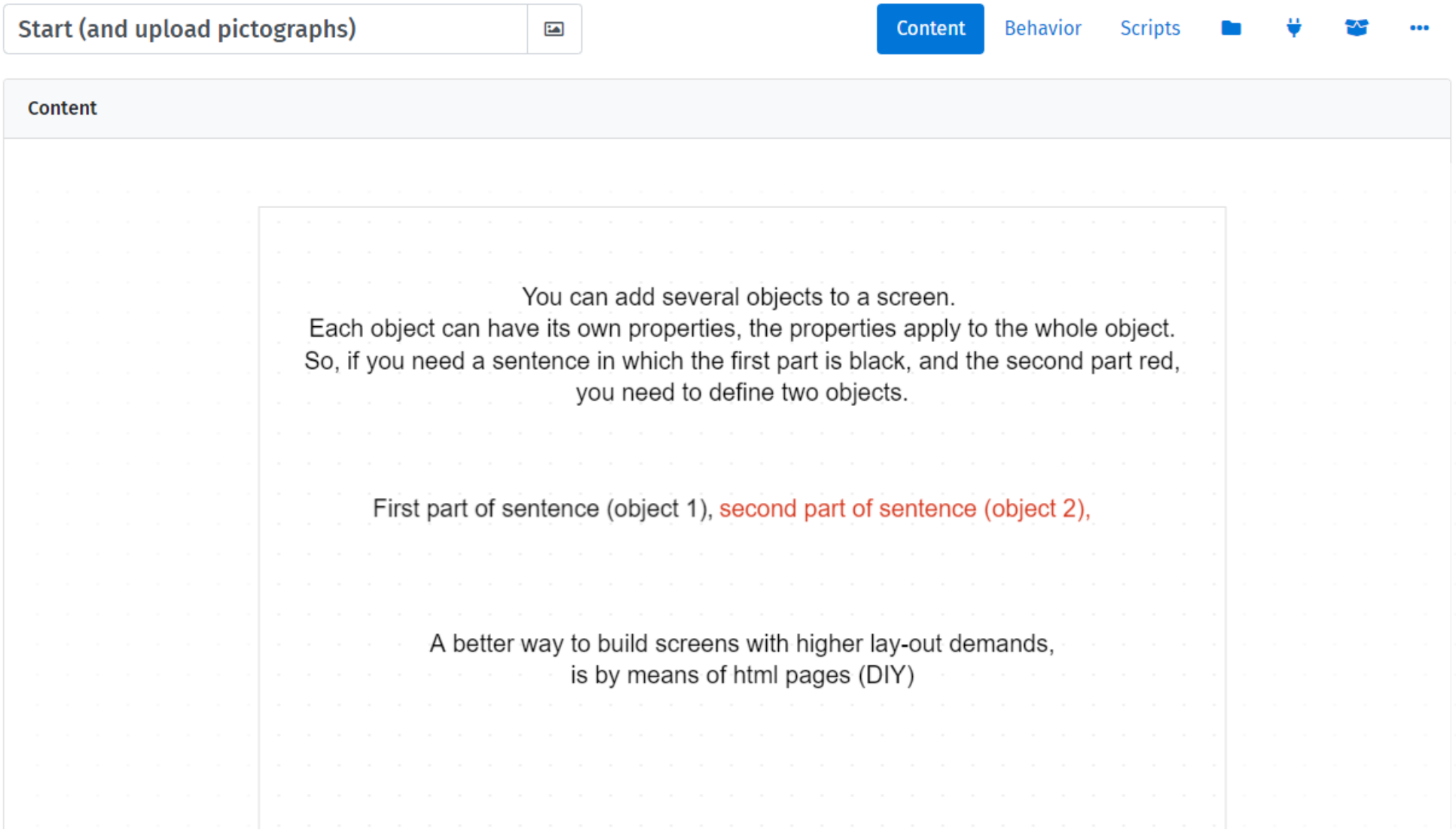
EACH ELEMENT HAS ‘CONTENT’ & ‘BEHAVIOR’



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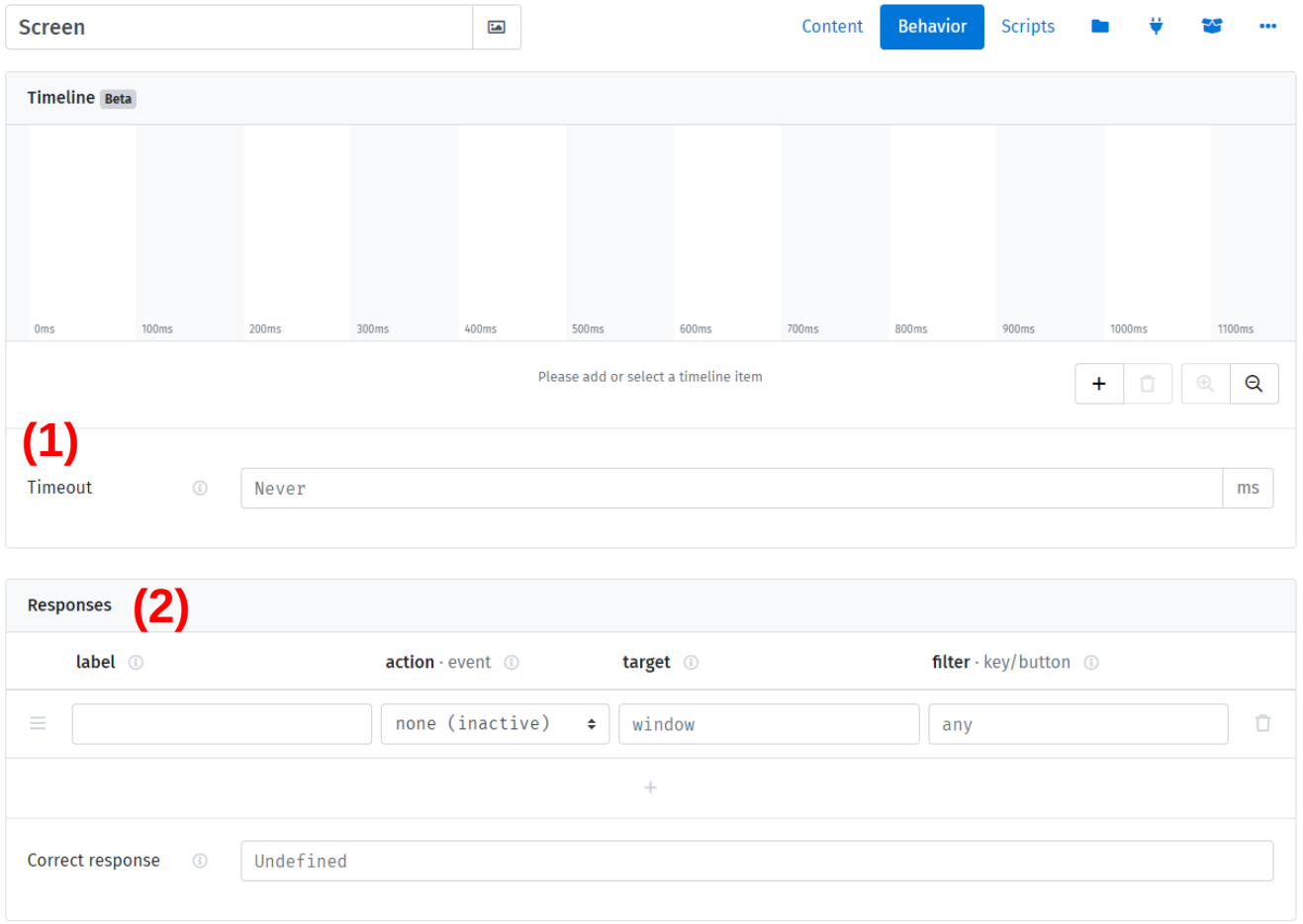
DEFINE THE BEHAVIOR

And tell your screen “how to behave”.

Proceed automatically to next page ➔ timeout **(1)**

Proceed upon response of participant. ➔ responses **(2)**



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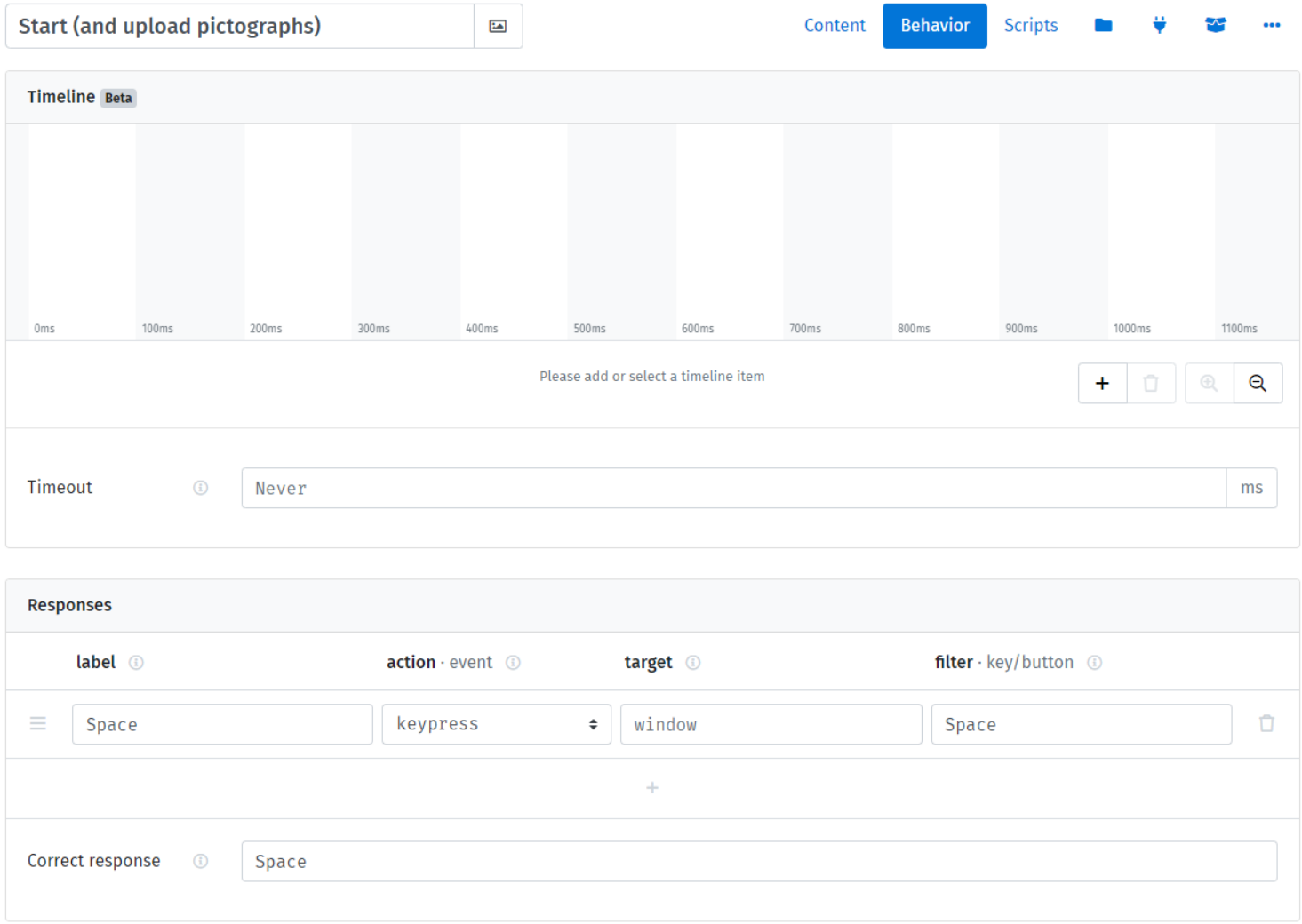
DEFINE THE BEHAVIOR



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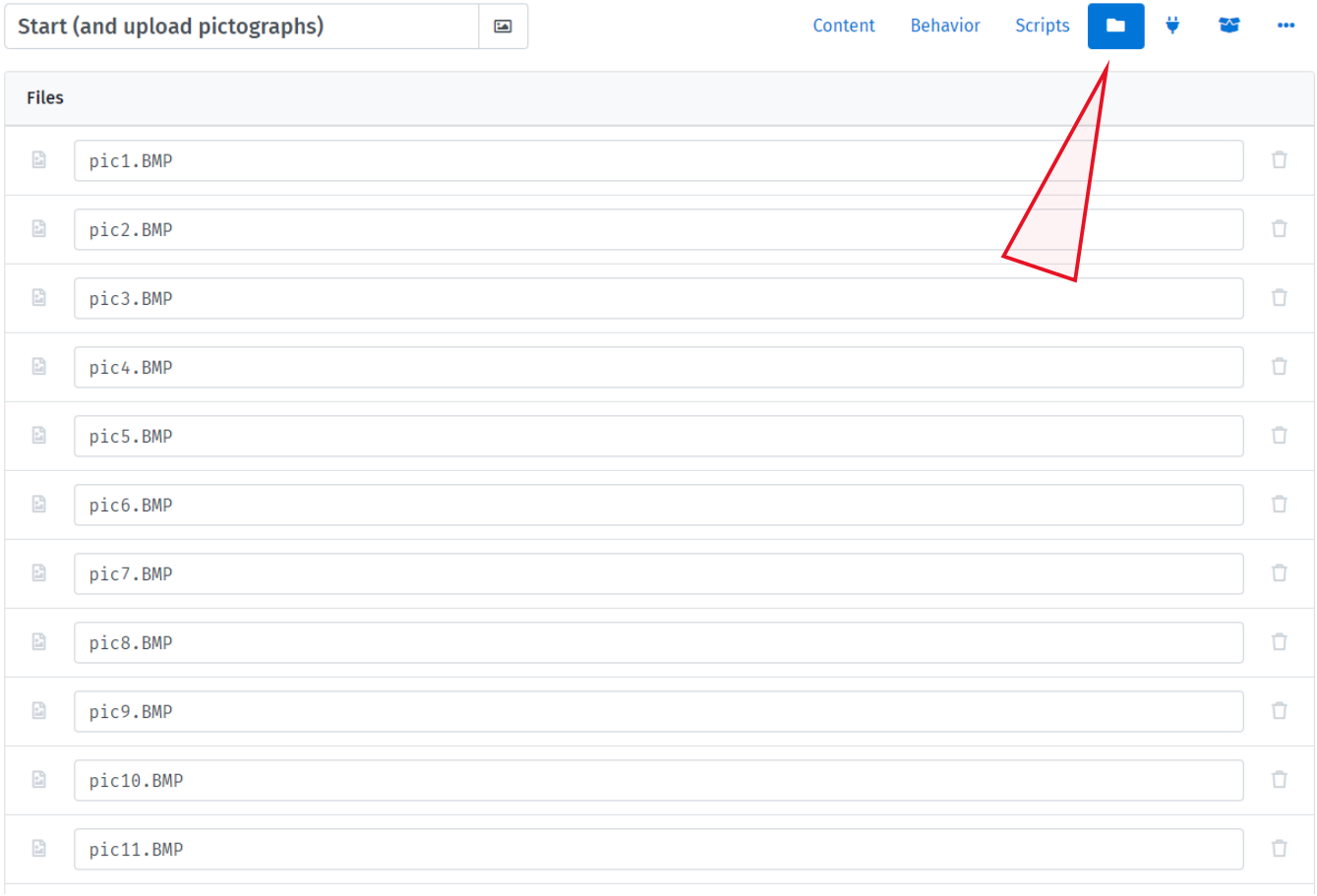
DEFINE/IMPORT EXTERNAL FILES (MEDIA)

- We need to upload **pictures** of the primes and the Chinese characters.
- I prefer to upload each ‘set’ of pictures in different screens/LABjs elements.
- In the first screen, I decided to upload the pictures of the Chinese characters.



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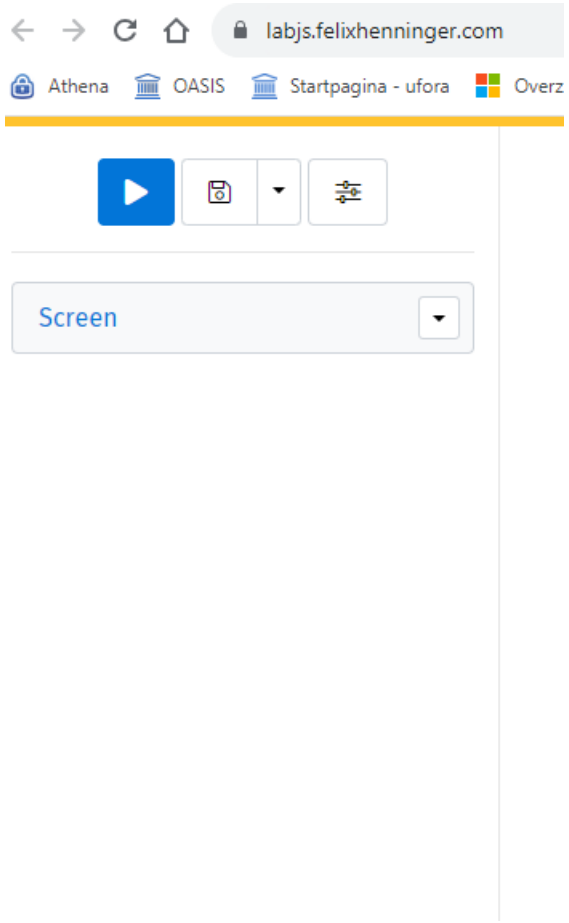
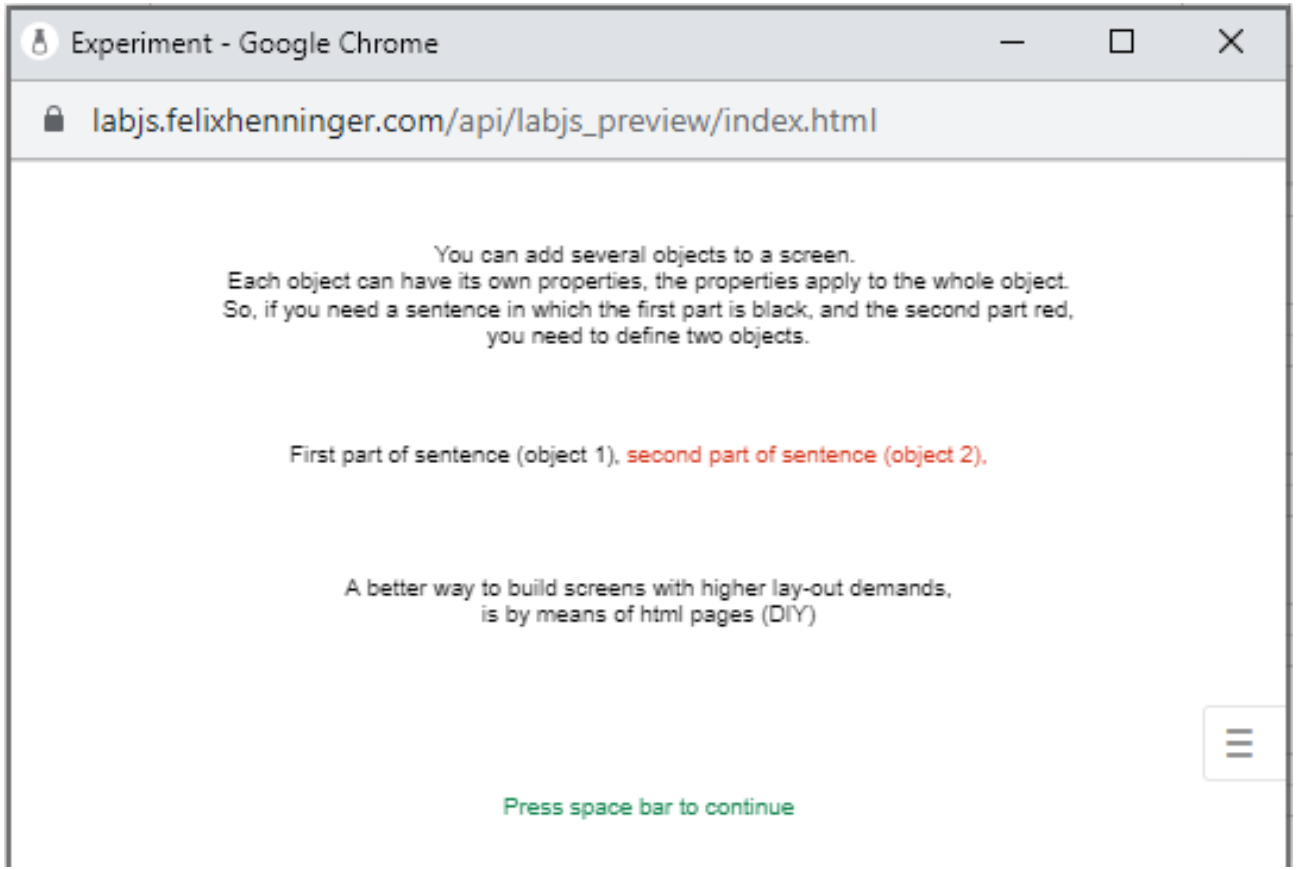
Chinse pictographs: see https://bkpayne.web.unc.edu/research-materials/

CHECK YOUR PROGRESS REGULARLY





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DIY

- Add additional instruction screens.
- See appendix for an example of instruction screens.

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THE TRUE WORK: PRIME, TARGET, RESPONSE

Each AMP trial consists of …

- A **prime** ➔ a randomly selected picture of Coca Cola or Pepsi Cola, presented for 75 ms.
- A '**white screen**' ➔ presented for 125 ms
- A **target** ➔ a randomly selected Chinese pictograph, presented for 100 ms
- A **mask** ➔ a grayish screen, waiting for the response of the participant

This '**sequence**' of actions is **repeated** 100 times.

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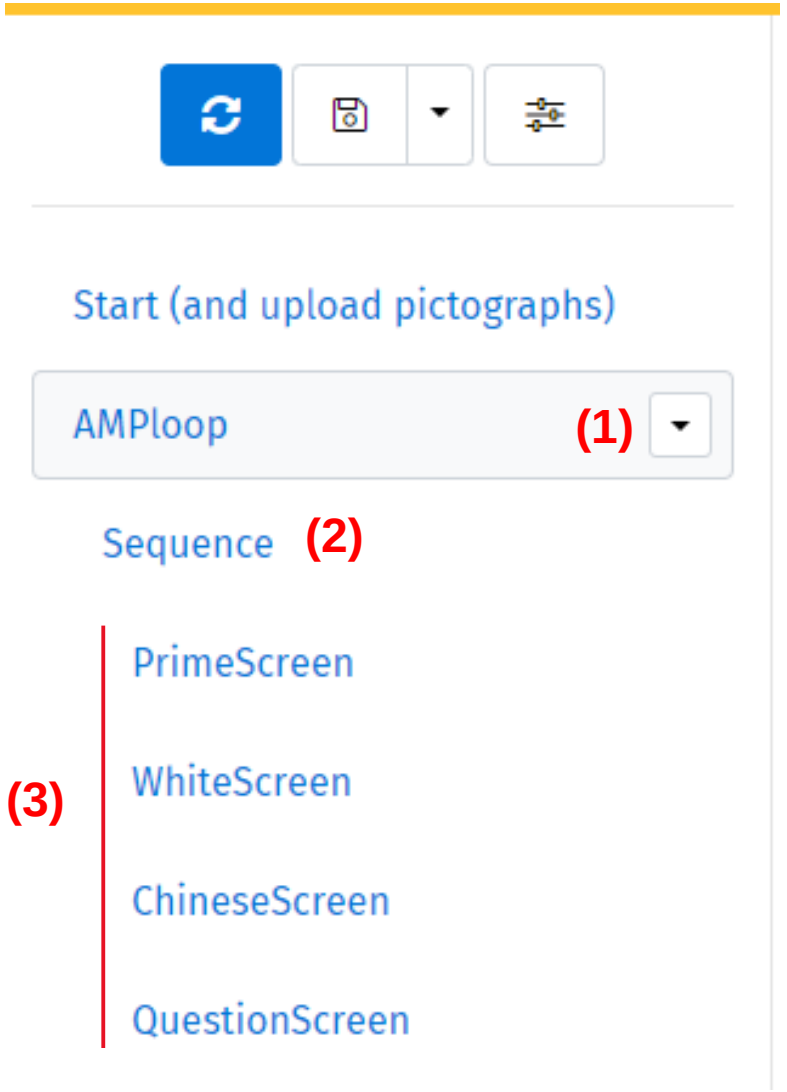
LOOPING SCREENS

Three different LabJS elements

- A ‘loop’ **(1)**
- A ‘Sequence’ **(2)** (in this case, not necessary, but easy to structure)
- A series of screens **(3)**



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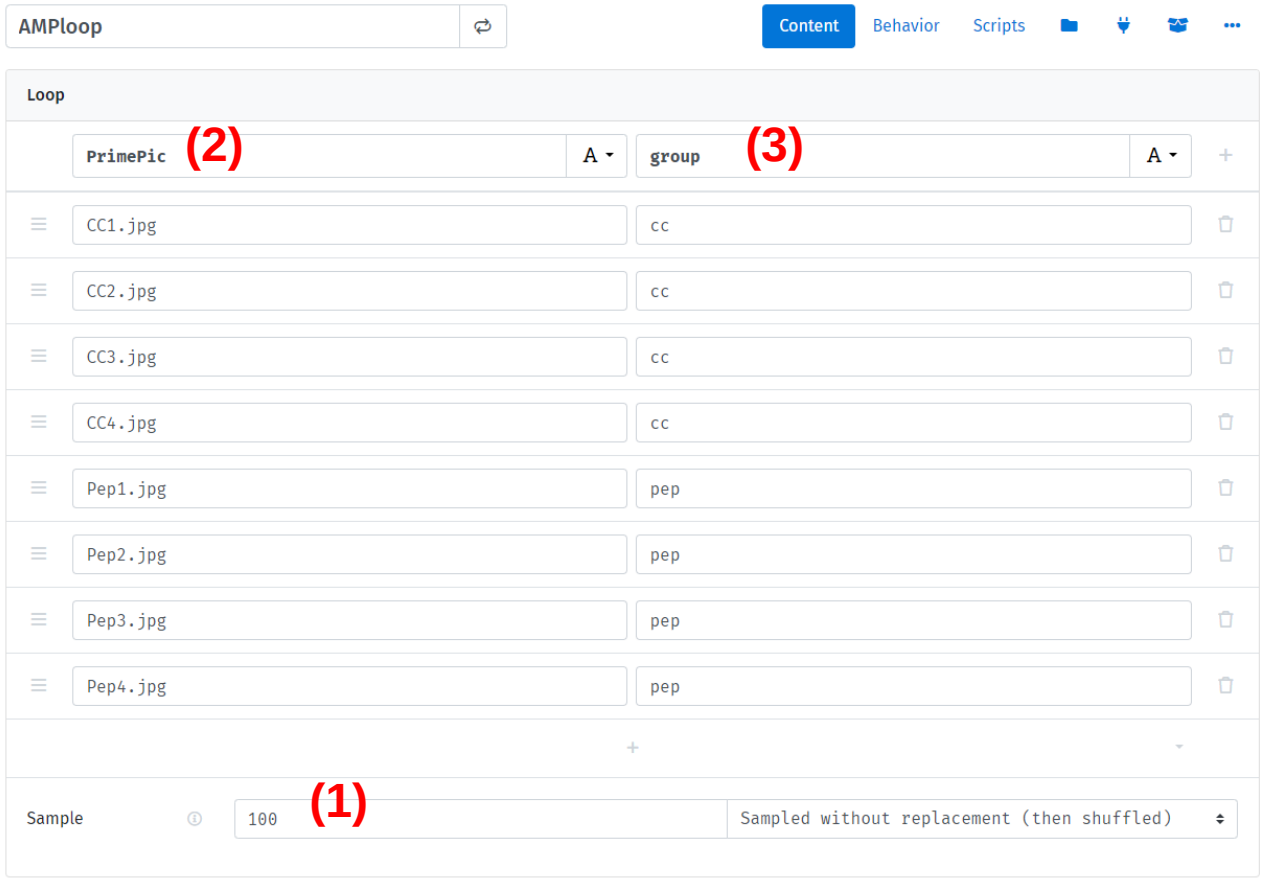
THE LOOP

- Every time **(1)** the loop is triggered, the program **randomly selects a** picture of Coca-Cola or Pepsi-Cola. **(2)**
- For each element in the loop, we can define different **variables.** Variables are called **parameters** in LabJS.
- We can **refer to these parameters** in any other page/element in the loop (and beyond).
- Next to the PrimePic that refers to the uploaded pictures, I added ‘group’ as a second parameter **(3)** (not needed, but makes data processing easier)



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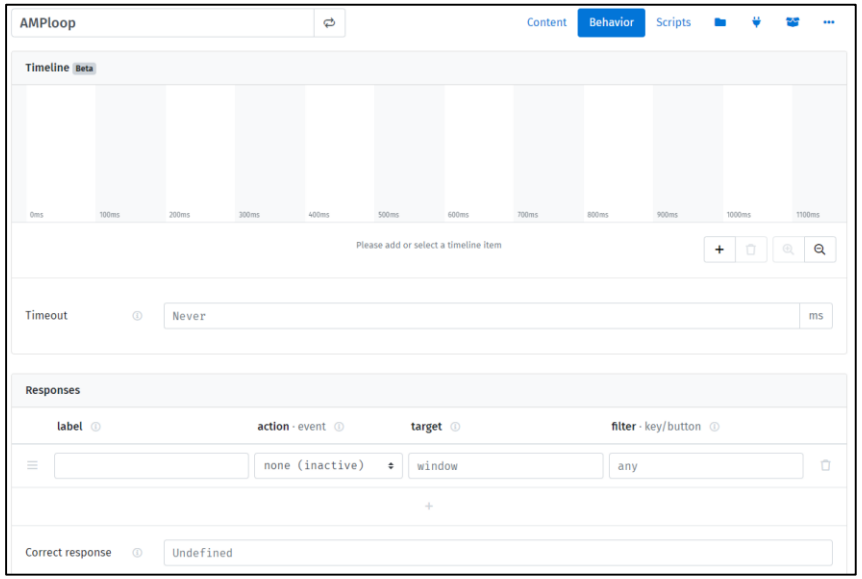
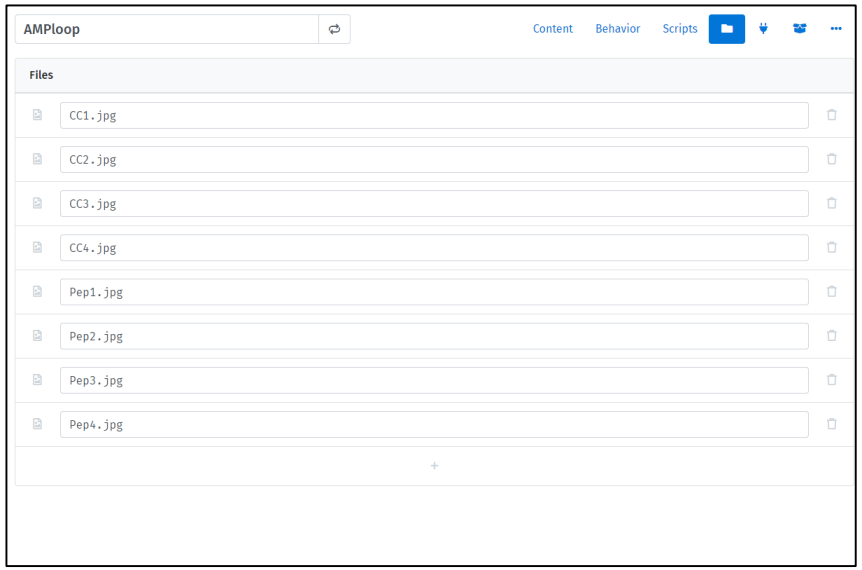
THE LOOP

- Has no specific behavior **(1)**
- Don’t forget to upload the prime pictures. **(2)**

BTW

- LabJS is case sensitive: Pic1.jpg ≠ pic1.JPG!
- Pictures of the same size makes life much easier!





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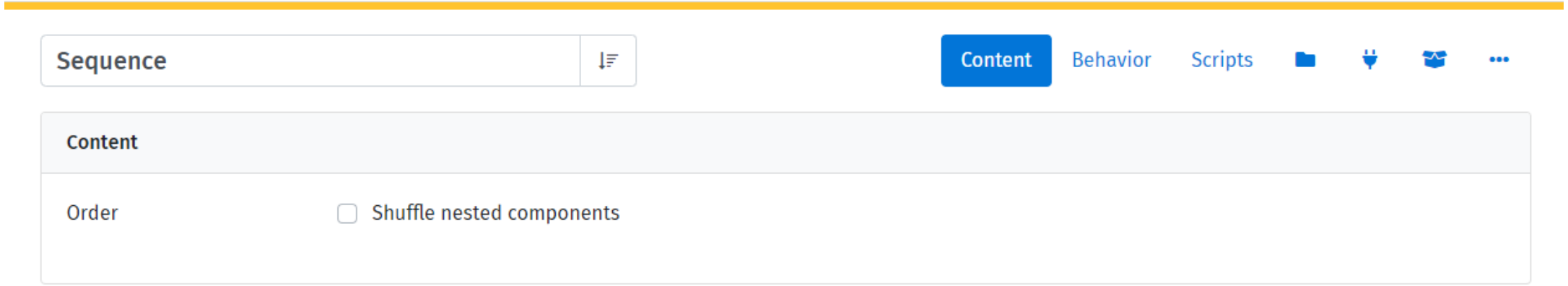
THE SEQUENCE

- Ensures that the program knows that the following/nested screens belongs together.
- No specific requirements



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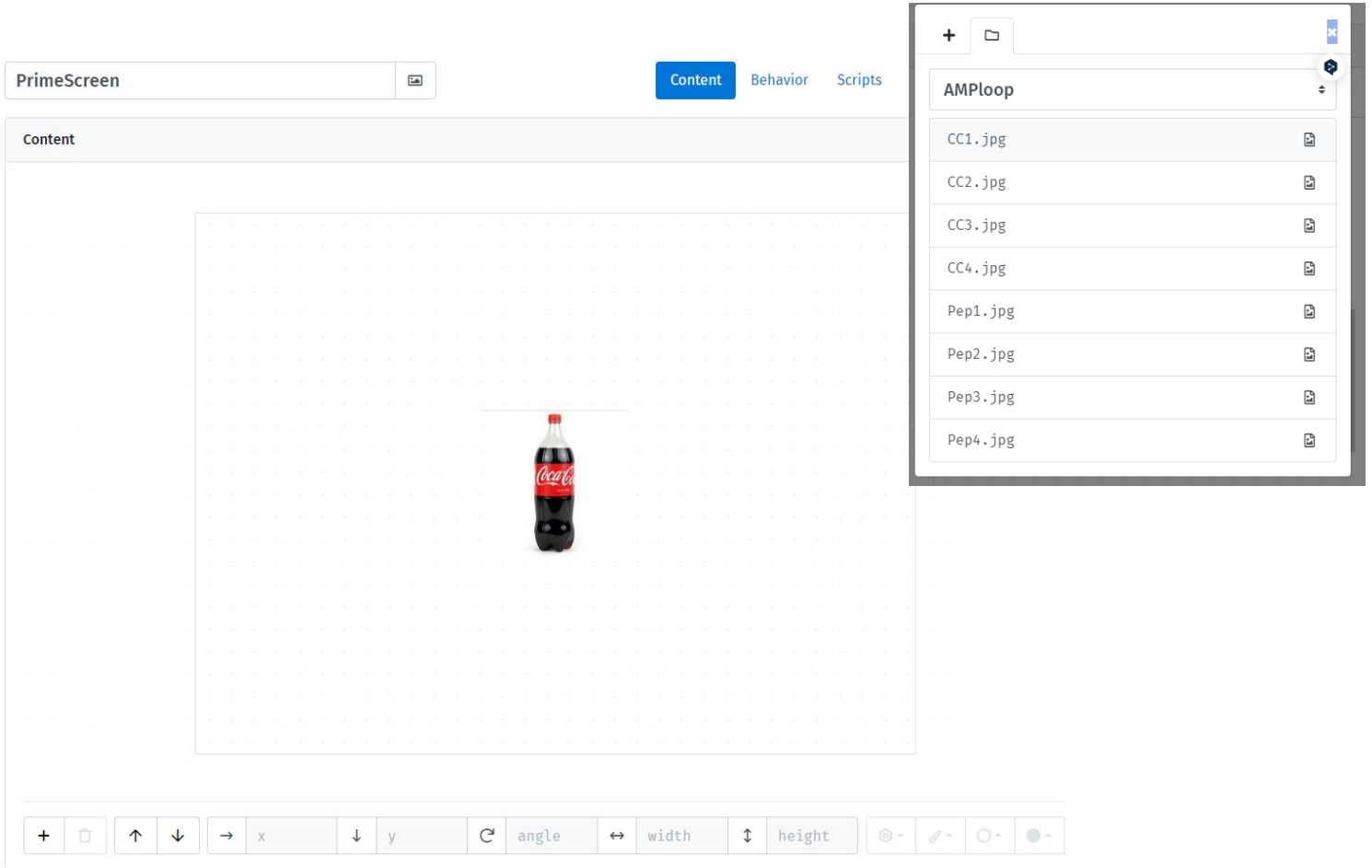
THE PRIME SCREEN

- Start with any of the Coca Cola or Pepsi Cola pictures
- Define the layout of the screen.



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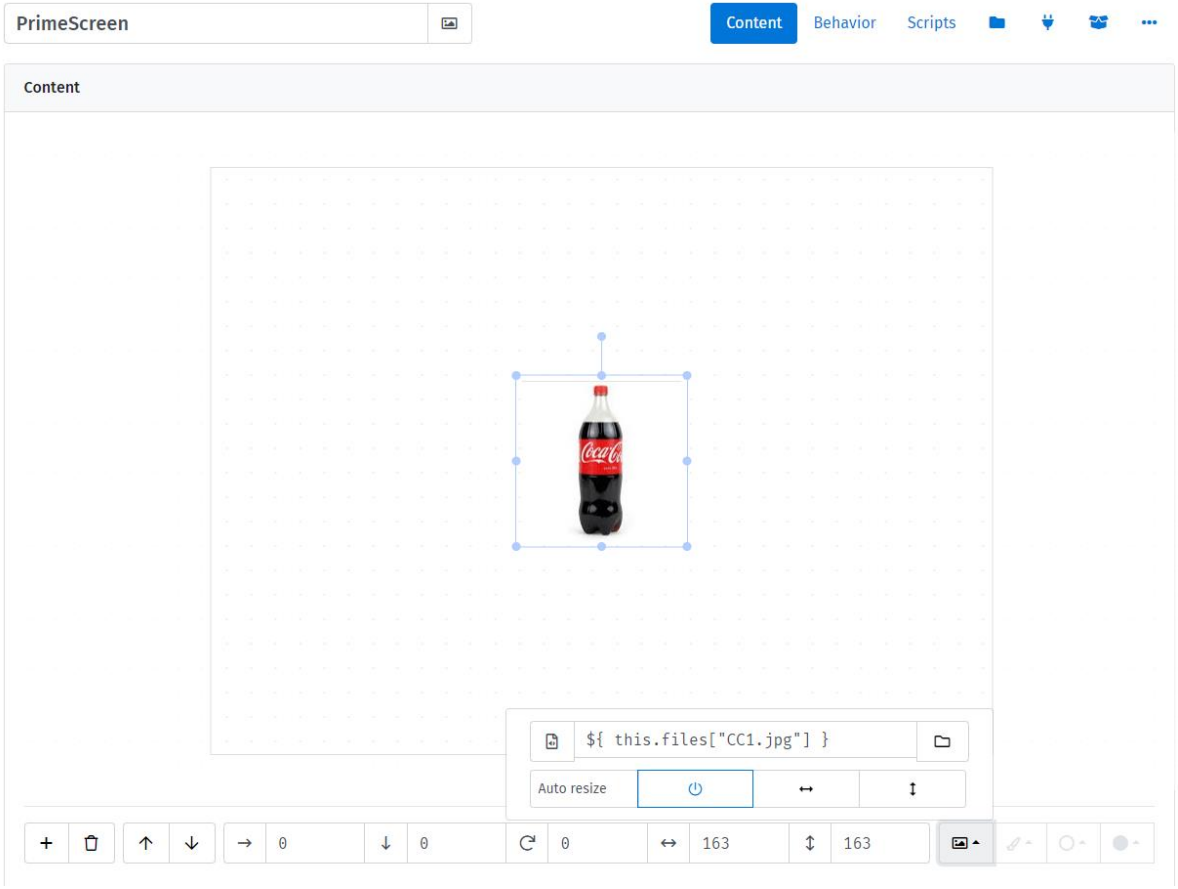
THE PRIME SCREEN

- Have a look to the features of the included picture **(1)**
- We only have to specify that, instead of the CC1.jpg picture, the program has to include the picture that is randomly selected by the loop
- Change “CC1.jpg” to the parameter name you used in the loop-content-screen:

  ${ this.files[this.parameters.PrimePic] }

  (this is JavaScript!) ☺
- The CC-bottle will turn grey
- You can do this trick with any value in any object/element



(1)

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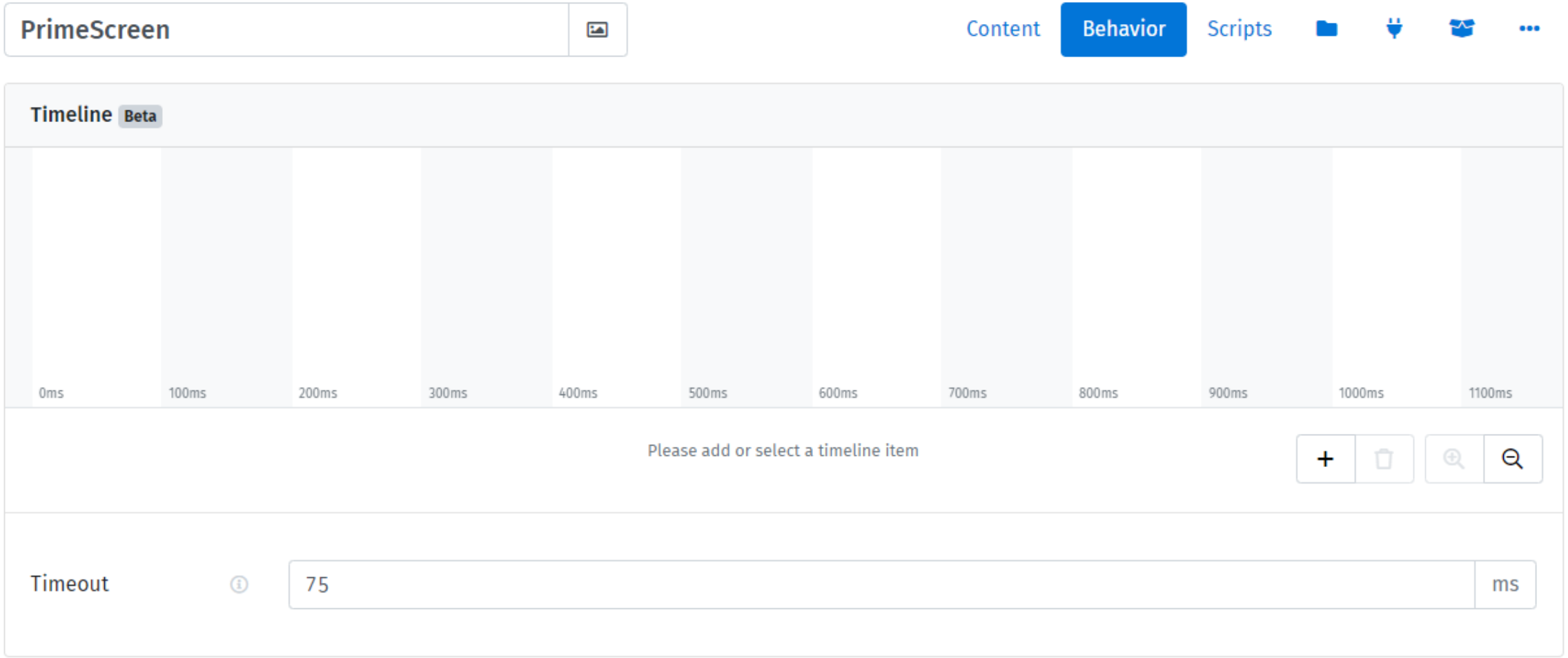
THE PRIME SCREEN - BEHAVIOR



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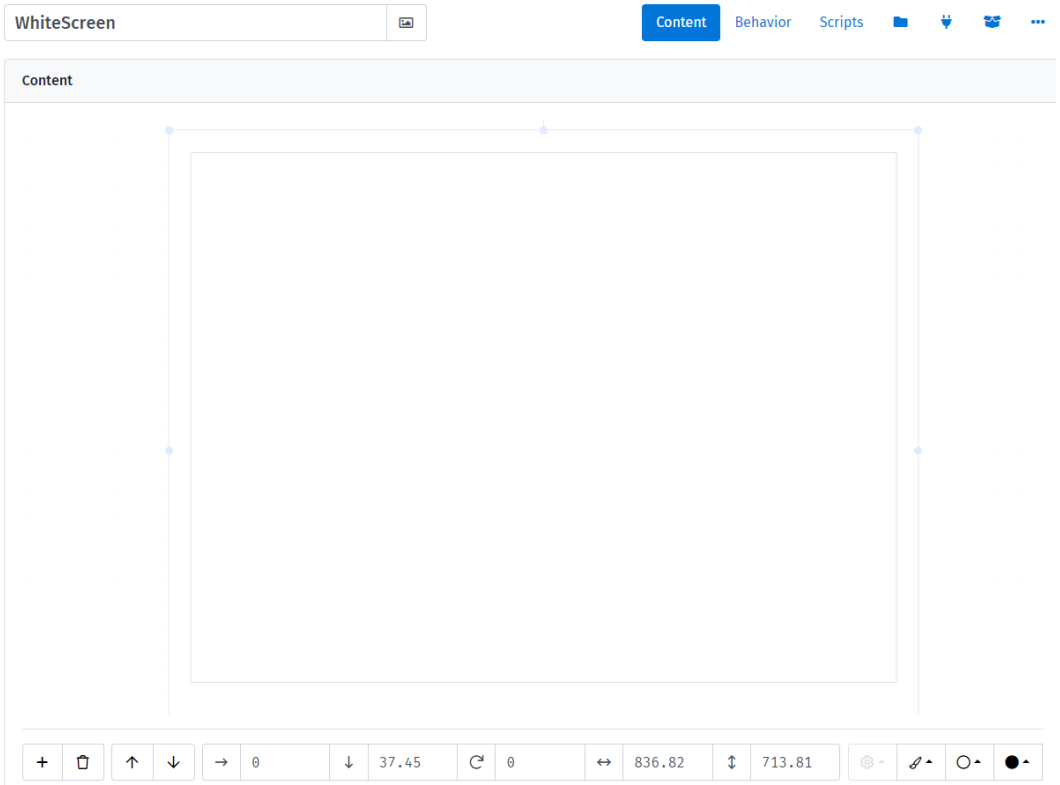
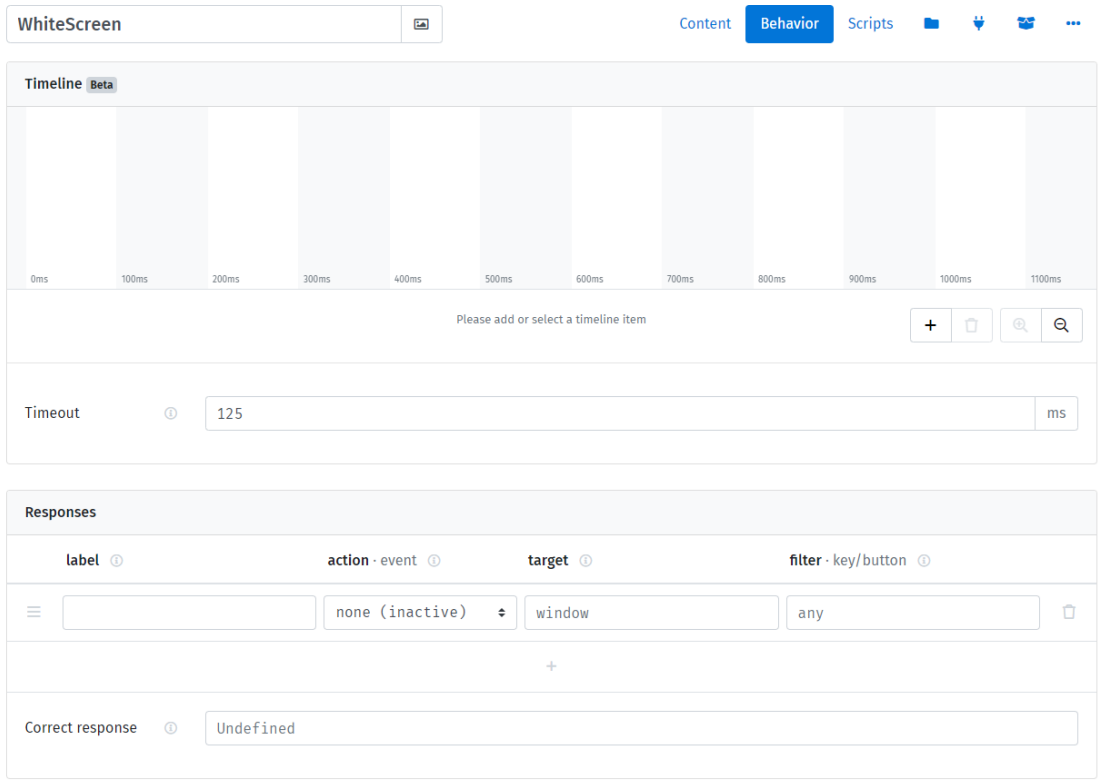
THE WHITE SCREEN

- Draw a white screen that covers the whole screen, to be sure that all pixels are turned white.





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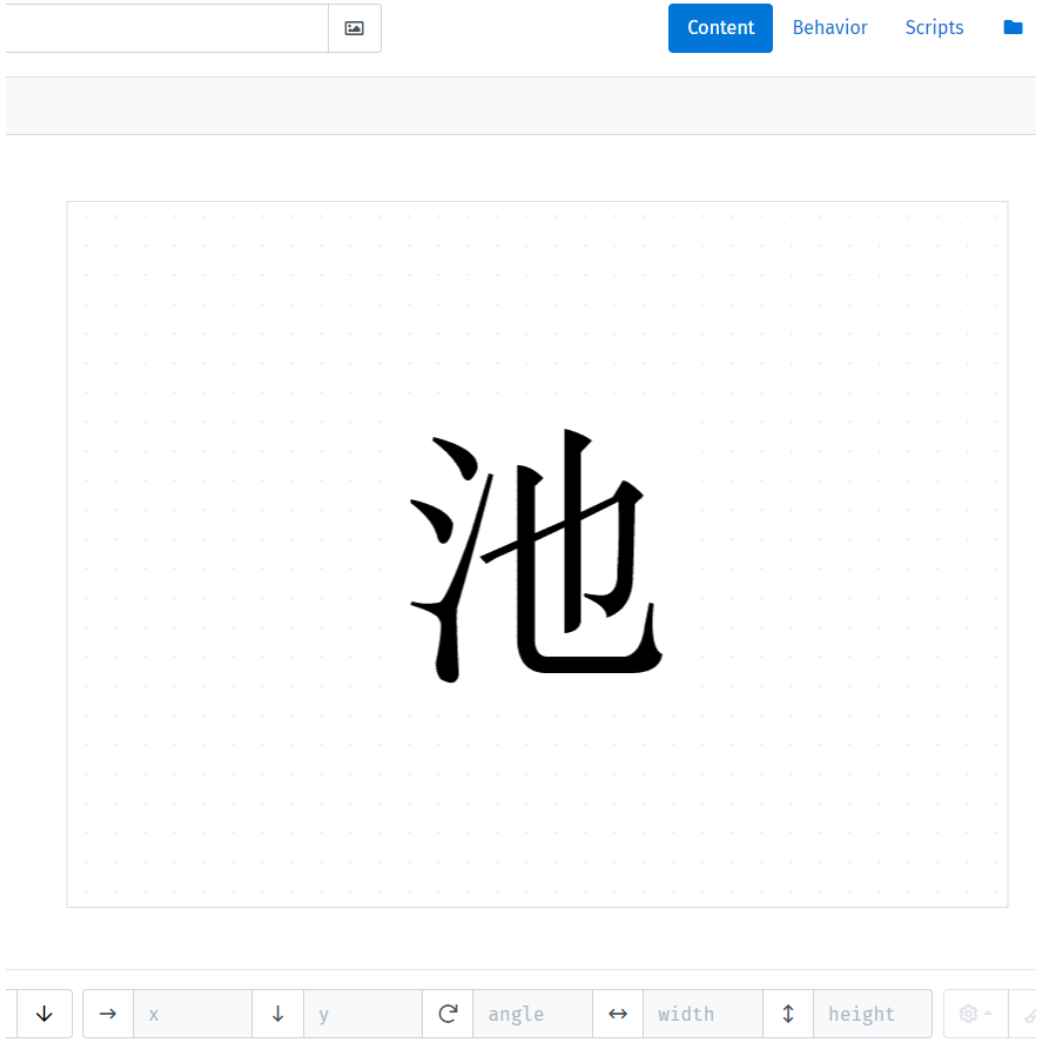
THE TARGET SCREEN

- Draw a screen with a picture of a Chinese character in the middle of the screen.
- **Problem: we cannot refer to a parameter in the loop**
- The Chinese character needs to be selected independently from the prime, and we don't have a full factorial design
- Solution: another bit of JavaScript!



(working LabJS file without any coding/fixed Chinese character: AMP_No_Rnd_Ideo.study)

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THE TARGET SCREEN - JAVASCRIPT

```
${ this.files[ this.formula( [array] ) ]  }
```

```
${ this.files[ this.random.choice( ["pic1.bmp", "pic2.bmp", "pic3.bmp", "pic4.bmp", "pic5.bmp", "pic6.bmp", "pic7.bmp", "pic8.bmp",
"pic9.bmp", "pic10.bmp", "pic11.bmp", "pic12.bmp", "pic13.bmp", "pic14.bmp", "pic15.bmp", "pic16.bmp", "pic17.bmp", "pic18.bmp",
"pic19.bmp", "pic20.bmp", "pic21.bmp", "pic22.bmp", "pic23.bmp", "pic24.bmp", "pic25.bmp", "pic26.bmp", "pic27.bmp", "pic28.bmp",
"pic29.bmp", "pic30.bmp", "pic31.bmp", "pic32.bmp", "pic33.bmp", "pic34.bmp", "pic35.bmp", "pic36.bmp", "pic37.bmp", "pic38.bmp",
"pic39.bmp", "pic40.bmp", "pic41.bmp", "pic42.bmp", "pic43.bmp", "pic44.bmp", "pic45.bmp", "pic46.bmp", "pic47.bmp", "pic48.bmp",
"pic49.bmp", "pic50.bmp", "pic51.bmp", "pic52.bmp", "pic53.bmp", "pic54.bmp", "pic55.bmp", "pic56.bmp", "pic57.bmp", "pic58.bmp",
"pic59.bmp", "pic60.bmp", "pic61.bmp", "pic62.bmp", "pic63.bmp", "pic64.bmp", "pic65.bmp", "pic66.bmp", "pic67.bmp", "pic68.bmp",
"pic69.bmp", "pic70.bmp", "pic71.bmp", "pic72.bmp", "pic73.bmp", "pic74.bmp", "pic75.bmp", "pic76.bmp", "pic77.bmp", "pic78.bmp",
"pic79.bmp", "pic80.bmp", "pic81.bmp", "pic82.bmp", "pic83.bmp", "pic84.bmp", "pic85.bmp", "pic86.bmp", "pic87.bmp", "pic88.bmp",
"pic89.bmp", "pic90.bmp", "pic91.bmp", "pic92.bmp", "pic93.bmp", "pic94.bmp", "pic95.bmp", "pic96.bmp", "pic97.bmp", "pic98.bmp",
"pic99.bmp", "pic100.bmp"] ) ]  }
```

(see also Appendix for full JavaScript)

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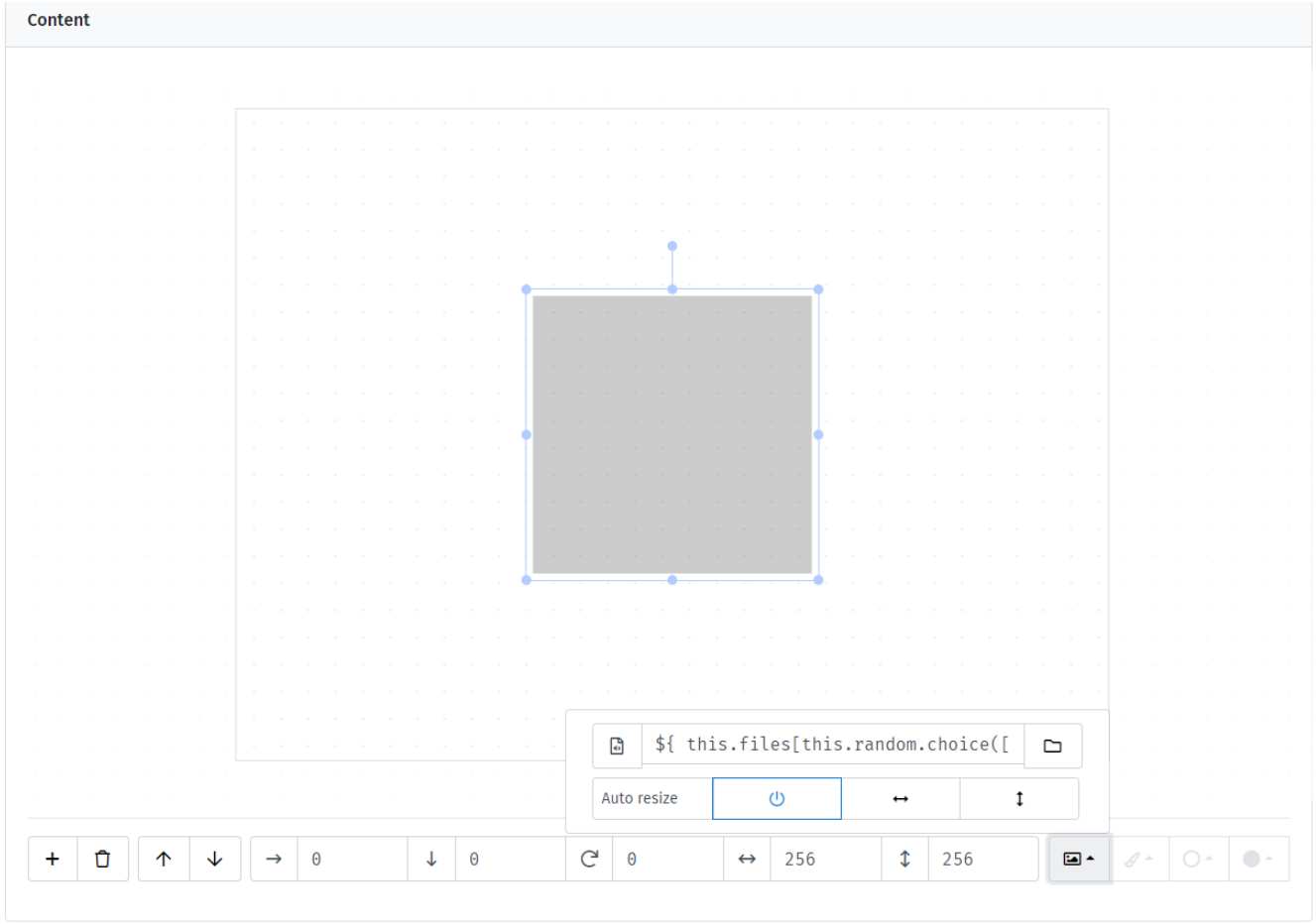
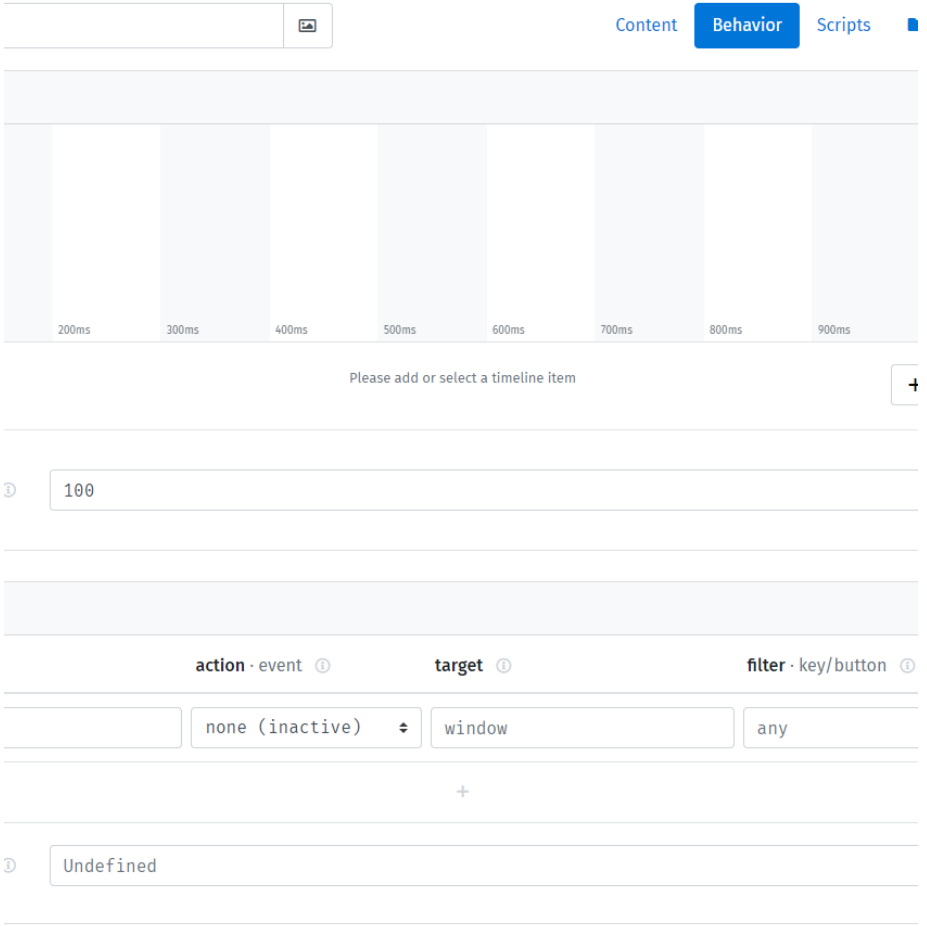
THE TARGET SCREEN - FINAL





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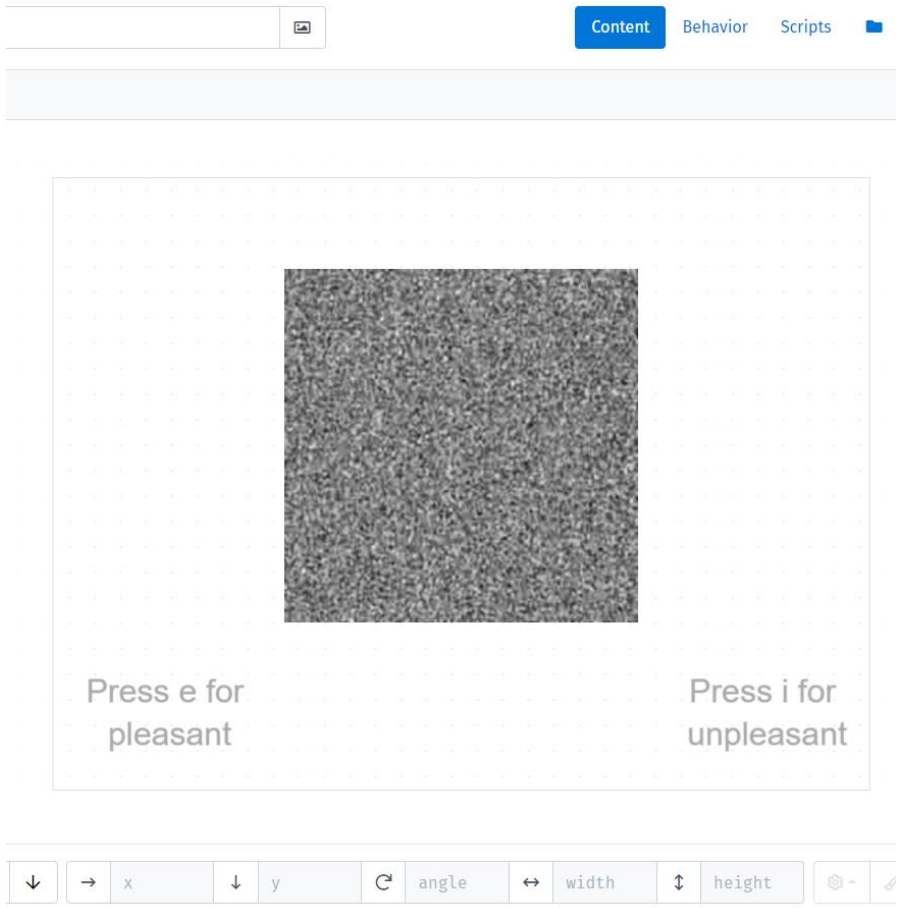
THE QUESTION SCREEN - CONTENT

- A basic screen with a picture (the mask) and two text objects (i.e., reminders for correct responses)



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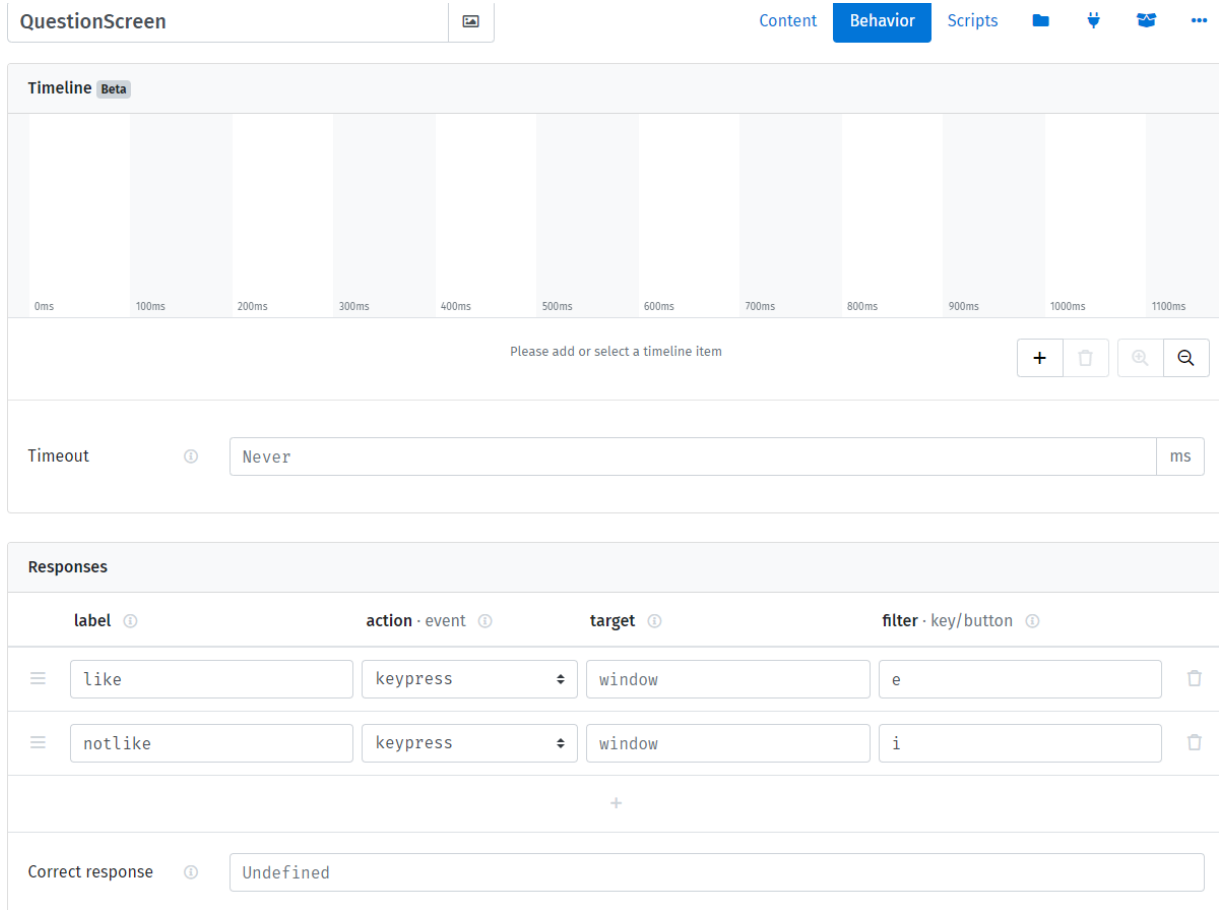
THE QUESTION SCREEN - BEHAVIOR

- **Action:** defines what actions define a response (mouse movement, keypress, …)
- **Filter:** defines the key on which can be pressed to continue
- **Label:** how the action is saved in the datafile.

Only **keypresses** e and i will trigger the next loop, and these actions are saved as ‘like’ and ‘dislike’ in the dataset.



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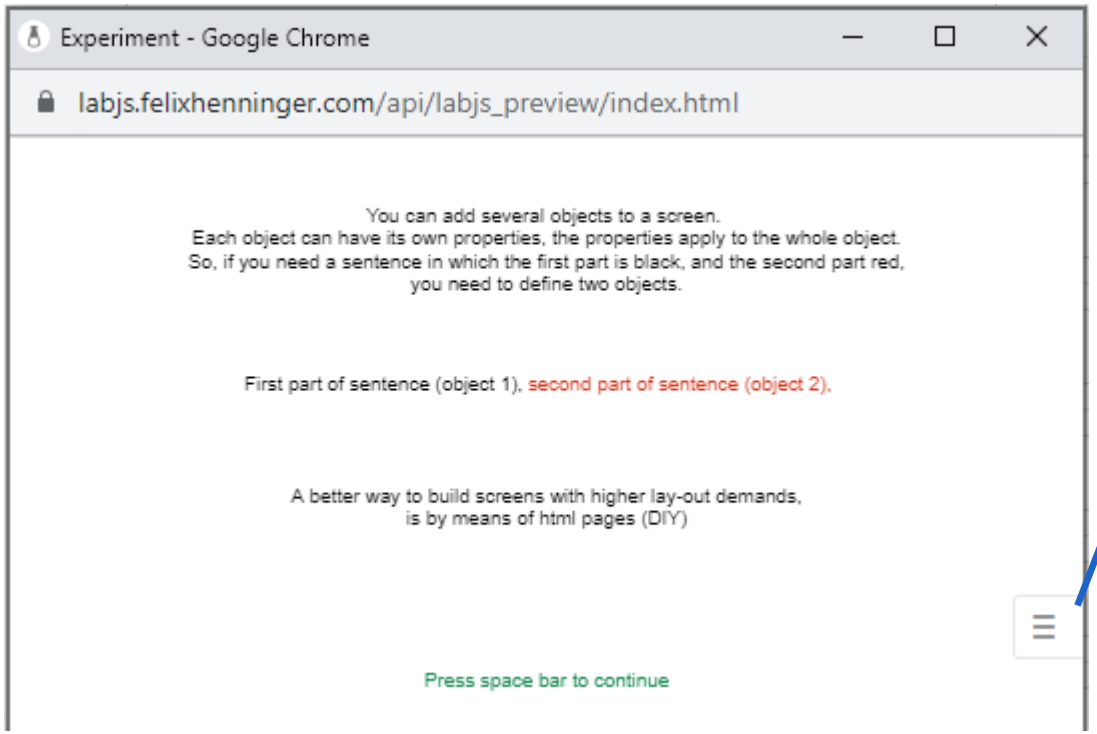
THE AMP IS READY FOR TESTING!



Click on this button to see how and which data is collected!

(working LabJS file with JavaScript /random Chinese character: AMP_Script_Rnd.study)

(full version, with all instructions, practice trials, and test trials: AMP_FullVersion.study)

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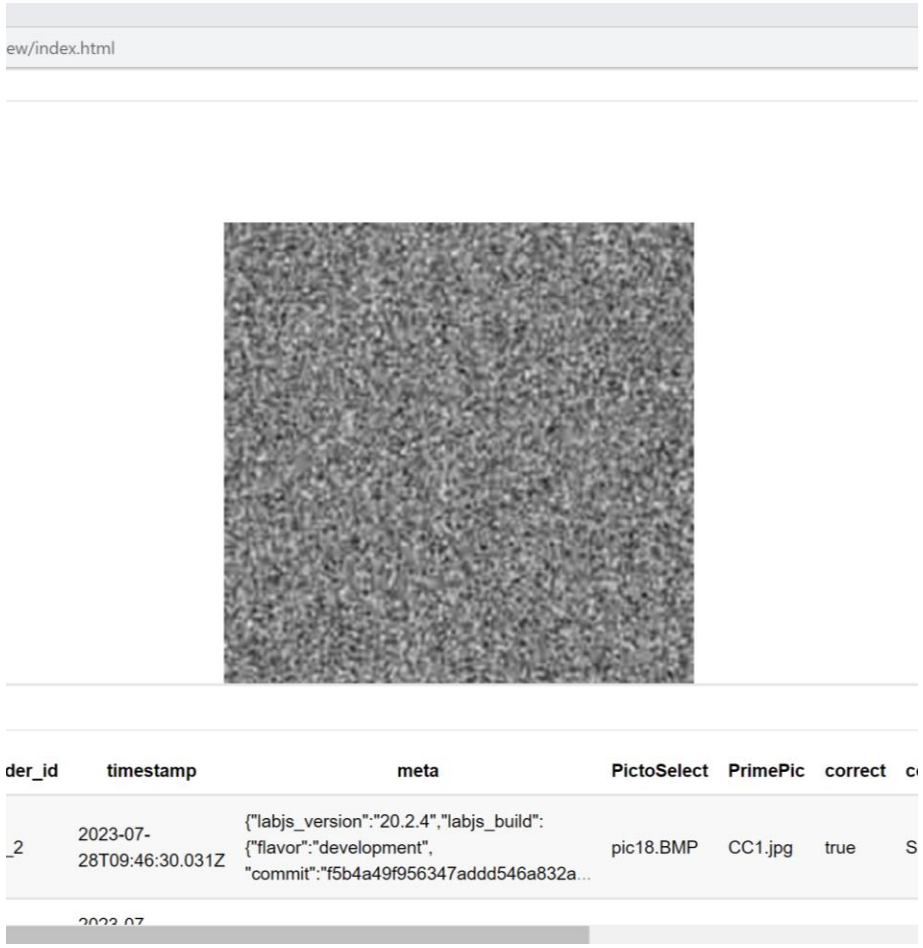
THE DATA SCREEN WHEN TESTING

- The ‘oldest’ data come at the bottom, newer data is shown on top.

- Most important variables:
  - Sender: the LABjs element
  - The variables referring to the presented stimuli
  - Duration: the time that the stimulus was on screen
  - The variables referring to the self-defined parameters
  - Whether the response was correct or not (but not so important for the AMP)



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THE DATA IN SPREADSHEET

- The program renders CSV files (*)
- Each presented screen = one data line
- First presented screen = top; last presented screen = bottom

(*) if you open file in Excel, with “,” as decimal separator, most time-related data will not be correctly interpreted.

➔ change options in Excel
➔ replace , by ; and . by , (e.g., in Notepad)
➔ Use another program to open/analyze data

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THE AMP EFFECT

The AMP effect

- The proportion of pleasant versus unpleasant judgments of the targets given a specific prime (or prime category) can be used as a proxy for the implicit attitude toward that prime

Outliers

- Do not remove outliers, unless good reasons to do so (e.g., always pressing the same key)

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FURTHER IMPROVEMENT – 1.

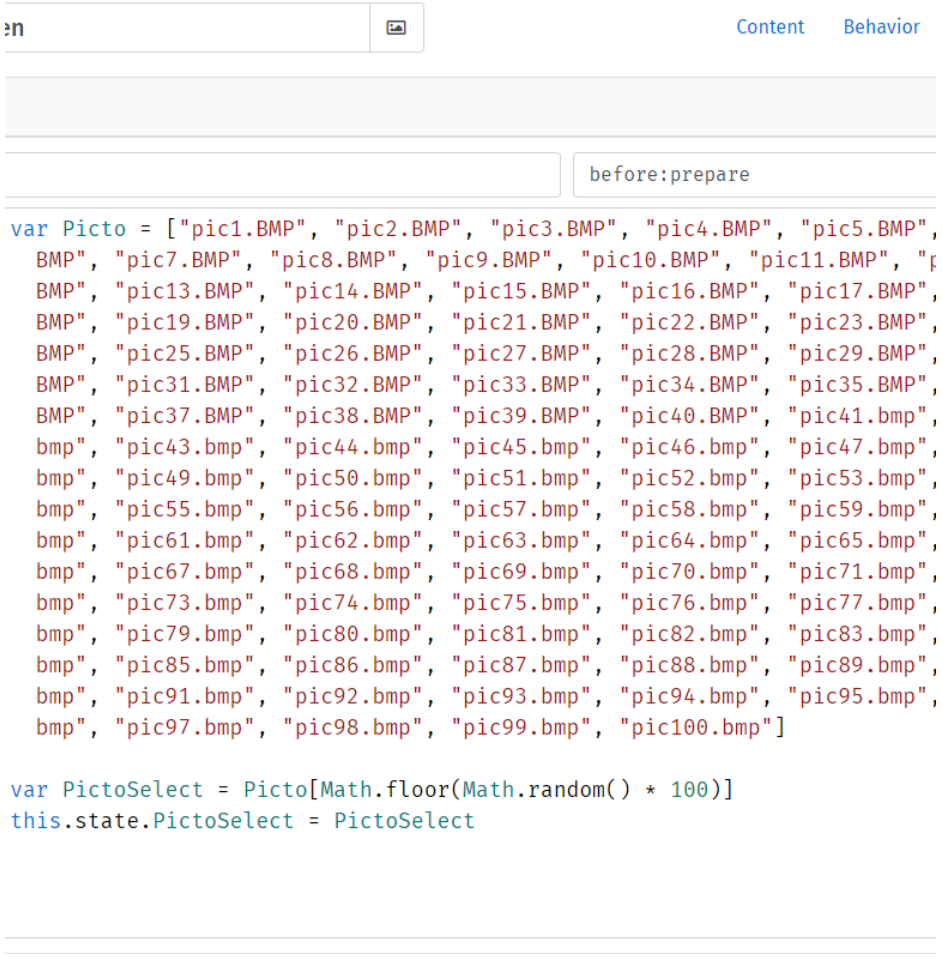
- Now, the JavaScript is written in the boxes where the features of the objects are defined. This is not so handy.
- Put the JavaScript on the Script pages, create parameters in these scripts, and refer to the newly created parameters in the boxes where the feature of the objects are defined
- Need help? Watch https://labjs.readthedocs.io/en/latest/learn/logic/index.html
- Before you start experimenting, you should know the difference between “this.state” and “this.parameters”, and know why/when to use the “tardy” option in the behavior screen.

POSSIBLE SOLUTION - THE SCRIPT PAGE

My solution

- Define a variable “Picto” as an array containing all the names of the pictures (case sensitive!) (*)
- Set the variable “PictoSelect” to a randomly selected element of the Picto-array.
- Activate the selected PictoSelect

(*) you may define var Picto earlier in the experiment too.



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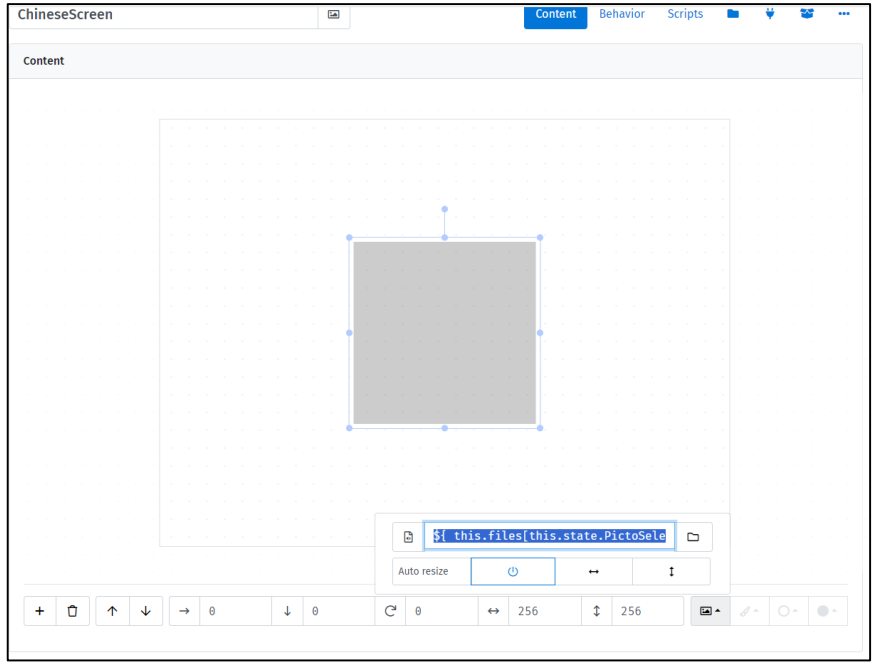
POSSIBLE SOLUTION – CONTENT & BEHAVIOR

Content

- Refer to ${ this.files[this.state.PictoSelect] } as the to be presented picture.



Behavior

- Tardy: the picture is only selected when the screen is presented (rather than when the whole program is compiled)

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FURTHER IMPROVEMENT – 2.

The Chinese character is selected completely at random ➔ the same character may be selected more than once.

Possible solution.

- Define the picture array at the beginning of the experiment
- Shuffle the array
- Define a counter, and set the value to 0.
- Select the item of the shuffled array that corresponds to the number of the counter (first selection: counter = 0 ➔ i.e., item in the array)
- Increase the counter by 1 every time a picture has been selected.

Other solution:

Use a JavaScript function for random selection without replacement (LabJS has some predefined functions for that) see: https://labjs.readthedocs.io/en/latest/reference/random.html

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FURTHER IMPROVEMENT – 2.

Instruction pages are defined as screens. A better, and more flexible way to define screens, is working with html pages instead.

Design screens with HTML:
https://labjs.readthedocs.io/en/latest/learn/html/index.html

Experiment in style:
https://labjs.readthedocs.io/en/latest/learn/css/index.html

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THE IAT

- Most IATs closely follows the “Standard” seven block IAT procedure as described in ‘Appendix A’ of Greenwald et al. (2022).

- “Greenwald, A. G., Brendl, M., Cai, H., Cvencek, D., Dovidio, J. F., Friese, M., ... & Wiers, R. W. (2022). Best research practices for using the Implicit Association Test. *Behavior research methods*, 1161-1180.”

Behavior Research Methods (2022) 54:1161–1180
https://doi.org/10.3758/s13428-021-01624-3

Best research practices for using the Implicit Association Test

Anthony G. Greenwald[1] · Miguel Brendl[2] · Huajian Cai[3] · Dario Cvencek[1] · John F. Dovidio[4] · Malte Friese[5] · Adam Hahn[6] · Eric Hehman[7] · Wilhelm Hofmann[8] · Sean Hughes[9] · Ian Hussey[9] · Christian Jordan[10] · Teri A. Kirby[11] · Calvin K. Lai[12] · Jonas W. B. Lang[9] · Kristen P. Lindgren[1] · Dominika Maison[13] · Brian D. Ostafin[14] · James R. Rae[15] · Kate A. Ratliff[16] · Adriaan Spruyt[9] · Reinout W. Wiers[17]

Accepted: 16 May 2021 / Published online: 13 September 2021

Abstract
Interest in unintended discrimination that can result from implicit attitudes and stereotypes (implicit biases) has stimulated many research investigations. Much of this research has used the Implicit Association Test (IAT) to measure association strengths that are presumed to underlie implicit biases. It had been more than a decade since the last published treatment of recommended best practices for research using IAT measures. After an initial draft by the first author, and continuing through three subsequent drafts, the 22 authors and 14 commenters contributed extensively to refining the selection and description of recommendation-worthy research practices. Individual judgments of agreement or disagreement were provided by 29 of the 36 authors and commenters. Of the 21 recommended practices for conducting research with IAT measures presented in this article, all but two were endorsed by 90% or more of those who felt knowledgeable enough to express agreement or disagreement; only 4% of the totality of judgments expressed disagreement. For two practices that were retained despite more than two judgments of disagreement (four for one, five for the other), the bases for those disagreements are described in presenting the recommendations. The article additionally provides recommendations for how to report procedures of IAT measures in empirical articles.

Keywords Implicit Association Test · recommended research practices · indirect attitude measurement · implicit social cognition

Introduction

Greenwald and Banaji (1995) reviewed methods and findings in an area of research that they identified as *implicit social cognition*. Their review focused on research by social and personality psychologists—and more specifically on research using *indirect* measures of attitudes, stereotypes, and self-esteem. Their concluding sentence was: “Perhaps the most significant remaining

The authors are grateful to the following colleagues for comments that substantially benefited this article: Mahzarin R. Banaji, Yoav Bar-Anan, Tessa Charlesworth, Jan De Houwer, John Jost, John F. Kihlstrom, Benedek Kurdi, Franziska Meissner, Gregory Mitchell, Brian A. Nosek, Marco Perugini, Klaus Rothermund, Jeffrey Sherman, and Colin T. Smith. 2nd through 22nd authors are alphabetical by last name

✉ Anthony G. Greenwald
agg@uw.edu

[1] University of Washington, Seattle, WA 98195–1525, USA

[9] Ghent University, Ghent, Belgium

[10] Wilfrid Laurier University, Waterloo, Canada

[11] University of Exeter, Exeter, UK

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THE IAT

The (standard) 7-block IAT (trial numbers in parentheses)

1. Classify the items for the two **target categories** (20)
2. Classify the items for the two **attribute categories** (20)
3. Classify items for **all 4 categories**, one attribute and one target category assigned to each of two keys, using the response assignment of Blocks 1 and 2 (20).
4. Same as **Block 3** (40)
5. Classify the **target categories with reversed** key assignments (compared to Block 1) - more trials than in Block 1 (30).
6. Classify items **for all 4 categories**, now using the **reversed** key assignments practiced in Block 5 for the target categories (20).
7. Same as **Block 6** (40).

The subject's task in each of the seven blocks is to provide **correct classifications** of stimulus items by pressing an assigned left- or right-positioned key on a computer keyboard - for example **"E"** and **"I"** - into their categories.

Block 3, 4, 6, & 7: a strict **alternation** between presenting an item from one of the two **target** categories on odd-numbered trials and an item from one of the two **attribute** categories on even-numbered trials

Attribution of target stimuli to response keys is **counterbalanced** between participants

The semi-random trial list (i.e., strict alternation of target and attribute trials) implies that the default options of LabJS are insufficient. The use of JavaScript is therefor unavoidable

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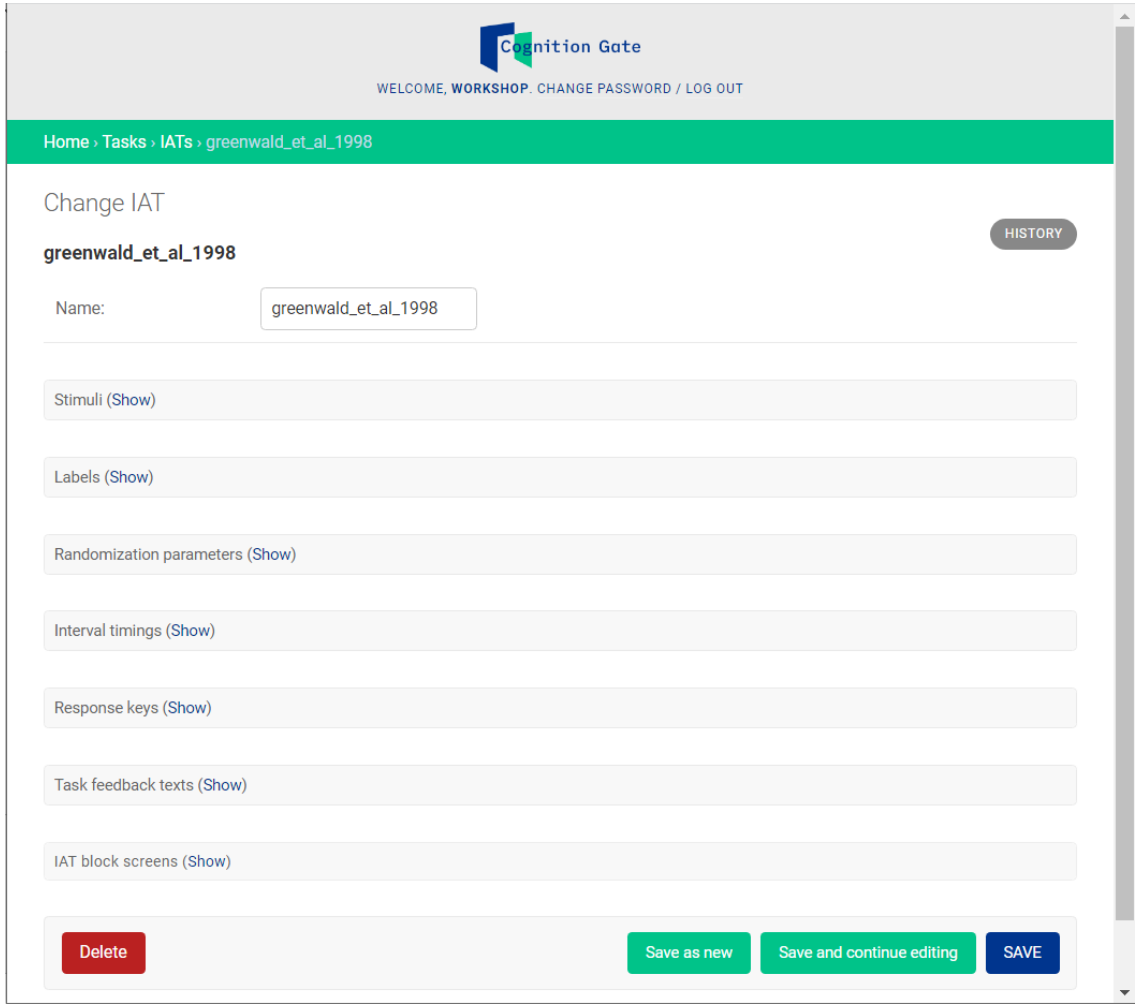
THE IAT USING COGNITION GATE



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APPENDIX

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APPENDIX 1 - INSTRUCTION SCREENS AMP

AMP instruction screens as in:

Payne, B. K., Govorun, O., & Arbuckle, N. L. (2008). Automatic attitudes and alcohol: Does implicit liking predict drinking? *Cognition and Emotion, 22,* 238-271.

http://bkpayne.web.unc.edu/wp-content/uploads/sites/7990/2015/02/WebpageAlc.AMP_.zip

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Welcome to the experiment!

In the following task we would like you to work on a computer task.

This task measures responses under distracting conditions. We will show you pairs of images flashed one after the other on the computer screen. The first image will be a real-life photo. Do nothing in response to the real-life images. This photo signals the second picture is about to appear.

Please press the SPACEBAR for more directions…

The second picture is of a Chinese symbol. We would like you to guess whether the symbol is more or less PLEASANT or UNPLEASANT than the average symbol. If you think the symbol is more PLEASANT than the average symbol press “P”, and if you think it is more UNPLEASANT than the average symbol press “Q”.

Remember, there are no correct answers; please respond with your own “gut” feeling as quickly as possible.

Please press the SPACEBAR for more directions…

You will now have some practice trials. **Please try your best not to let your reactions to the real-life photos influence your judgment of the Chinese symbols!**

Remember:

P = PLEASANT

Q= UNPLEASANT

When you are ready, please place your fingers on the appropriate keys.

Please press the SPACEBAR for some PRACTICE TRAILS…

You are now finished with the practice trials. When you are ready, please place your fingers on the appropriate keys and press the spacebar in order to start the experiment.

Please press the SPACEBAR to start the experiment…

You are now done with the experiment!

Thank you for your participation!

Please press the SPACEBAR to return to the Menu page

APPENDIX 2 – JAVASCRIPT USED

```
var Picto = ["pic1.bmp", "pic2.bmp", "pic3.bmp", "pic4.bmp", "pic5.bmp", "pic6.bmp", "pic7.bmp", "pic8.bmp", "pic9.bmp", "pic10.bmp", "pic11.bmp", "pic12.bmp", "pic13.bmp", "pic14.bmp", "pic15.bmp", "pic16.bmp", "pic17.bmp", "pic18.bmp", "pic19.bmp", "pic20.bmp", "pic21.bmp", "pic22.bmp", "pic23.bmp", "pic24.bmp", "pic25.bmp", "pic26.bmp", "pic27.bmp", "pic28.bmp", "pic29.bmp", "pic30.bmp", "pic31.bmp", "pic32.bmp", "pic33.bmp", "pic34.bmp", "pic35.bmp", "pic36.bmp", "pic37.bmp", "pic38.bmp", "pic39.bmp", "pic40.bmp", "pic41.bmp", "pic42.bmp", "pic43.bmp", "pic44.bmp", "pic45.bmp", "pic46.bmp", "pic47.bmp", "pic48.bmp", "pic49.bmp", "pic50.bmp", "pic51.bmp", "pic52.bmp", "pic53.bmp", "pic54.bmp", "pic55.bmp", "pic56.bmp", "pic57.bmp", "pic58.bmp", "pic59.bmp", "pic60.bmp", "pic61.bmp", "pic62.bmp", "pic63.bmp", "pic64.bmp", "pic65.bmp", "pic66.bmp", "pic67.bmp", "pic68.bmp", "pic69.bmp", "pic70.bmp", "pic71.bmp", "pic72.bmp", "pic73.bmp", "pic74.bmp", "pic75.bmp", "pic76.bmp", "pic77.bmp", "pic78.bmp", "pic79.bmp", "pic80.bmp", "pic81.bmp", "pic82.bmp", "pic83.bmp", "pic84.bmp", "pic85.bmp", "pic86.bmp", "pic87.bmp", "pic88.bmp", "pic89.bmp", "pic90.bmp", "pic91.bmp", "pic92.bmp", "pic93.bmp", "pic94.bmp", "pic95.bmp", "pic96.bmp", "pic97.bmp", "pic98.bmp", "pic99.bmp", "pic100.bmp"]

var PictoSelect = Picto[Math.floor(Math.random() * 100)]
this.state.PictoSelect = PictoSelect
```

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