An introduction to experiment building with OpenSesame

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http://www.cogsci.nl/smathot

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For resources, see http://osdoc.cogsci.nl/epos2015

Today

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- A short introduction (20 min)
- Create an experiment (75 min) …
- Coffee break
- … and some more (75 min)

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About OpenSesame

About OpenSesame

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- A graphical experiment builder
  - Drag-and-drop, point-and-click
  - Complement with Python scripting
- Open source
  - Free of charge
  - Source code available
- Cross platform
  - All major platforms
  - Runtime support for Android

About OpenSesame

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- A broad focus
  - Fits many types of research
- Psychophysics
  - Reaction time tasks, complex stimuli, etc.
- Neuroimaging
  - Parallel-port triggers, etc.
- Social psychology
  - Questionnaires, etc.
- Clinical applications
  - Test batteries, mobile (tablet-based) experiments, etc.

Support

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- Documentation
  - http://osdoc.cogsci.nl
- Community
  - http://forum.cogsci.nl
  - 1400+ members, daily activity, very responsive
- Outlook
  - Will OpenSesame still be there in [X] years?
  - Active development team
  - Large user base (±450,000 yearly hits for cogsci.nl)

Developers

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- A core team
  - Daniel Schreij (VU University Amsterdam)
  - Lotje van der Linden (CNRS / Aix-Marseille)
  - Edwin Dalmaijer (Oxford)
  - Eduard Ort (VU University Amsterdam)
  - Joshua Snell (CNRS / Aix-Marseille)
  - Sebastiaan Mathôt (CNRS / Aix-Marseille)
- Occasional contributors

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Teaching

Teaching

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- No licensing issues
- No steep learning curve
- Used for teaching at universities across the world
  - Used for many bachelor and master projects
  - Used as part of courses on programming/ research methods

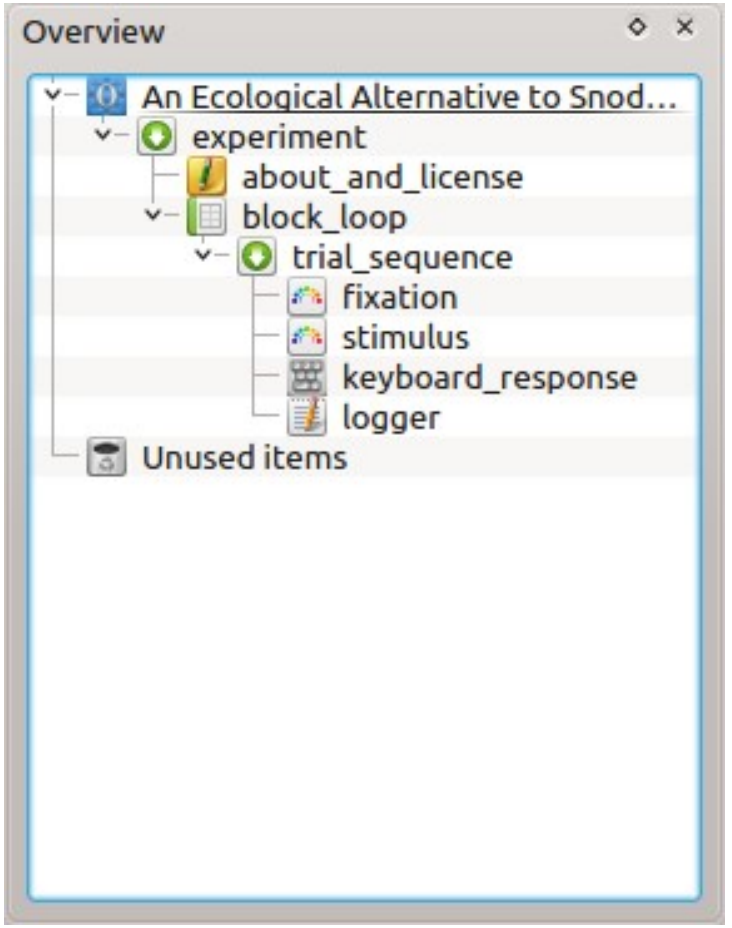
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Using OpenSesame

Items

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- **Items** are building blocks
- **Ten core items** offer common functionality



Plug-ins

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- **Plug-ins** are additional items
  - Eye trackers (PyGaze) (Dalmaijer, Mathôt, Van der Stigchel, 2014)
  - Video playback
  - Forms
  - Etc.
- Plug-ins also provide graphical controls
- New plug-ins can be written easily

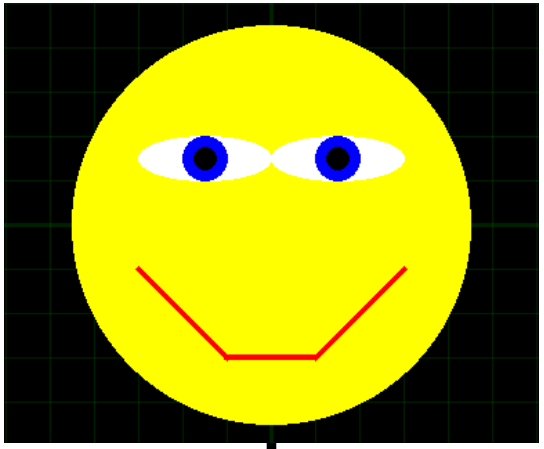
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User interface vs script

Combining GUI and script

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- The GUI generates a script
  - Custom language
  - Not Python!
- You can edit this script directly
- Afterwards you can continue using the GUI



Script (001, 015) Apply and

```
1  set duration "keypress"
2  set start_response_interval "no"
3  set description "Displays stimuli"
4  draw circle 0 0 288 fill=1 penwidth=1 color=yellow show_if="always"
5  draw line -96 32 -32 96 penwidth=4 color=red show_if="always"
6  draw line 32 96 96 32 penwidth=4 color=red show_if="always"
7  draw line -32 96 32 96 penwidth=4 color=red show_if="always"
8  draw ellipse -96 -64 96 32 fill=1 penwidth=1 color=white show_if="always"
9  draw ellipse 0 -64 96 32 fill=1 penwidth=1 color=white show_if="always"
10 draw ellipse -64 -64 32 32 fill=1 penwidth=1 color=blue show_if="always"
11 draw ellipse 32 -64 32 32 fill=1 penwidth=1 color=blue show_if="always"
12 draw fixdot -48 -48 color=black show_if="always"
13 draw fixdot 48 -48 color=black show_if="always"
```

Combining GUI and script

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- You can create a prototype display using the GUI, and add variables using scripting
- Prototype script:
  - `draw image 0.0 0.0 "gaze_left.png" scale=1.0 center=1 show_if="always"`
- Variable script:
  - `draw image 0.0 0.0 "gaze_[gaze_cue].png" scale=1.0 center=1 show_if="always"`

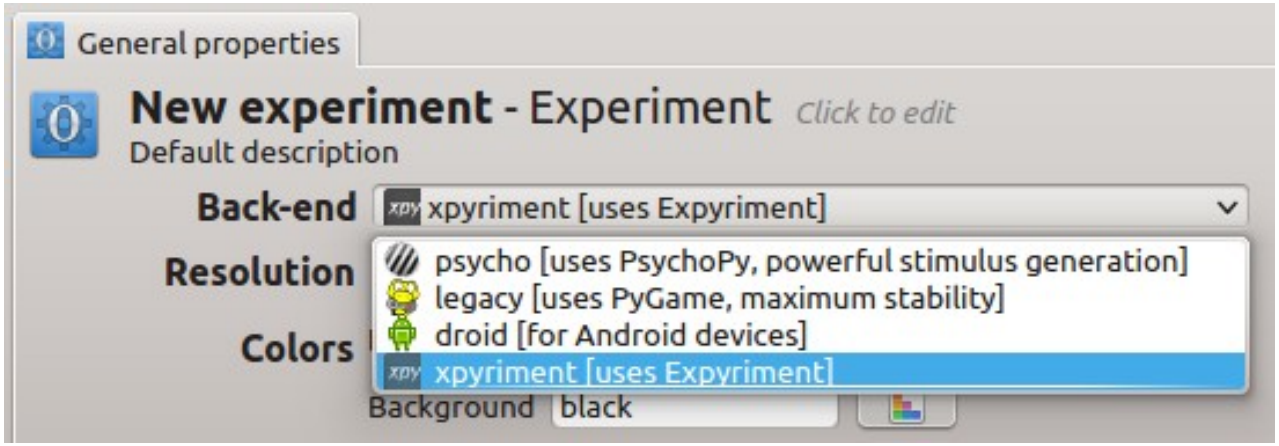
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Back-ends

Back-ends

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- There are many ways to control the display, input, etc.
- OpenSesame is not tied to one method
- **Back-ends** can be flexibly added, like plug-ins



Back-ends

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- Each back-end has its own benefits
  - Temporal precision
  - Stability
  - Extra functionality
  - Cross-platform support

- **Xpyriment** → Simple with good temporal precision. Expyriment-based (Krause & Lindeman, 2013)
- **Legacy** → Fallback, modest temporal precision
- **Psycho** → PsychoPy based, good temporal precision (Peirce, 2007)
- **Droid** → For Android devices

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Design

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- Multisensory cueing task
- Participants see:
  - cat
  - dog
  - capybara
- … and hear:
  - meow
  - bark

Design

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- Task:
  - dog → tap left
  - cat → tap right
  - capybara → no response
- Hypotheses:
  - Congruent sound and image (cat + meow, or dog + bark) → fast response
  - Incongruent sound and image (cat + bark, or dog + meow) → slow response
  - When there is a capybara, most false responses are congruent with the sound

Design

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- Formally: $\underline{S}_N \times V_3 \times A_2$
- What kind of design is this?
  - Within-subjects or between-subjects?
  - Fully crossed?
  - How many factors with how many levels?


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The Free Way to Super Science

References

Dalmaijer, E., Mathôt, S., & Van der Stigchel, S. (2014). PyGaze: An open-source, cross-platform toolbox for minimal-effort programming of eyetracking experiments. *Behavior Research Methods*, *46*(4), 913–921. doi:10.3758/s13428-013-0422-2

Krause, F., & Lindemann, O. (2013). Expyriment: A Python library for cognitive and neuroscientific experiments. *Behavior Research Methods*. doi:10.3758/s13428-013-0390-6

Mathôt, S., Schreij, D., & Theeuwes, J. (2012). OpenSesame: An open-source, graphical experiment builder for the social sciences. *Behavior Research Methods*, *44*(2), 314–324. doi:10.3758/s13428-011-0168-7

Peirce, J. W. (2007). PsychoPy: Psychophysics software in Python. *Journal of Neuroscience Methods*, *162*(1-2), 8–13. doi:10.1016/j.jneumeth.2006.11.017