> Motion-induced blindness

Presentation

Franck.Dernoncourt@gmail.com

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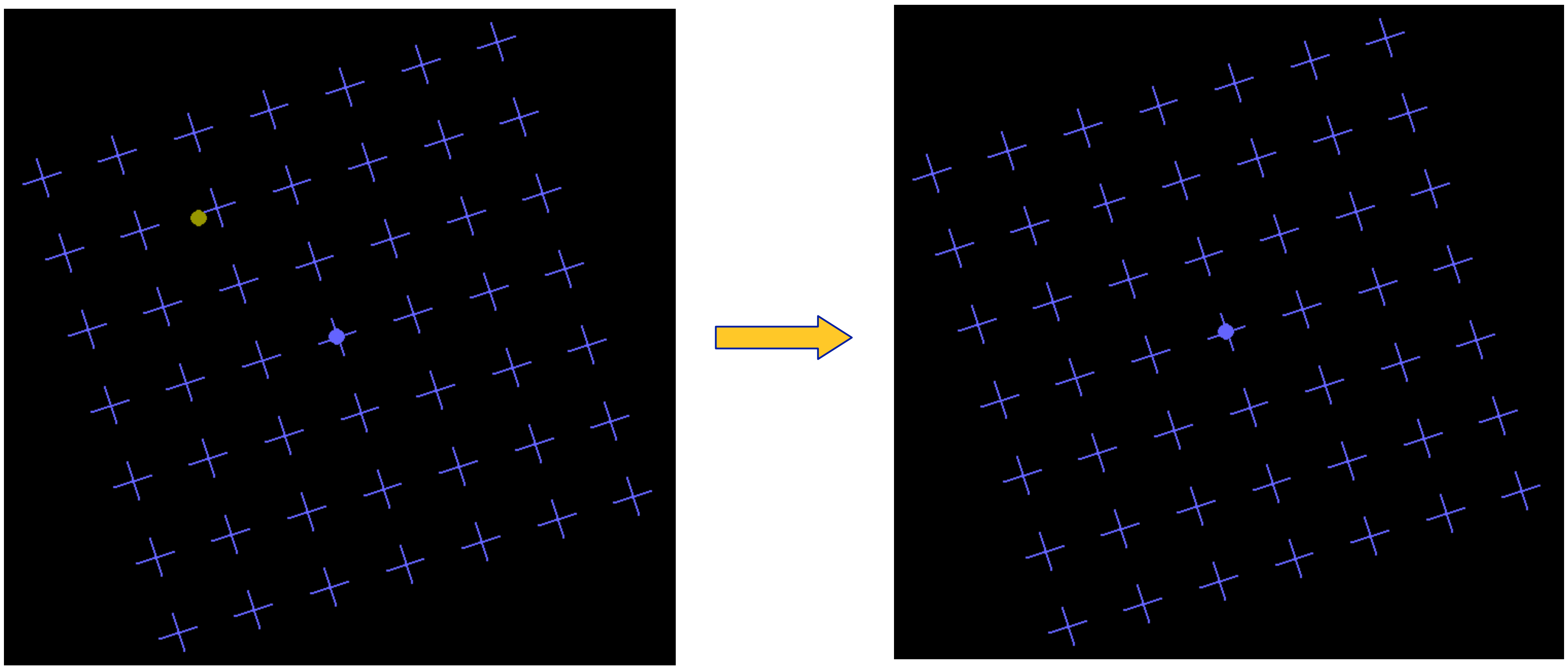
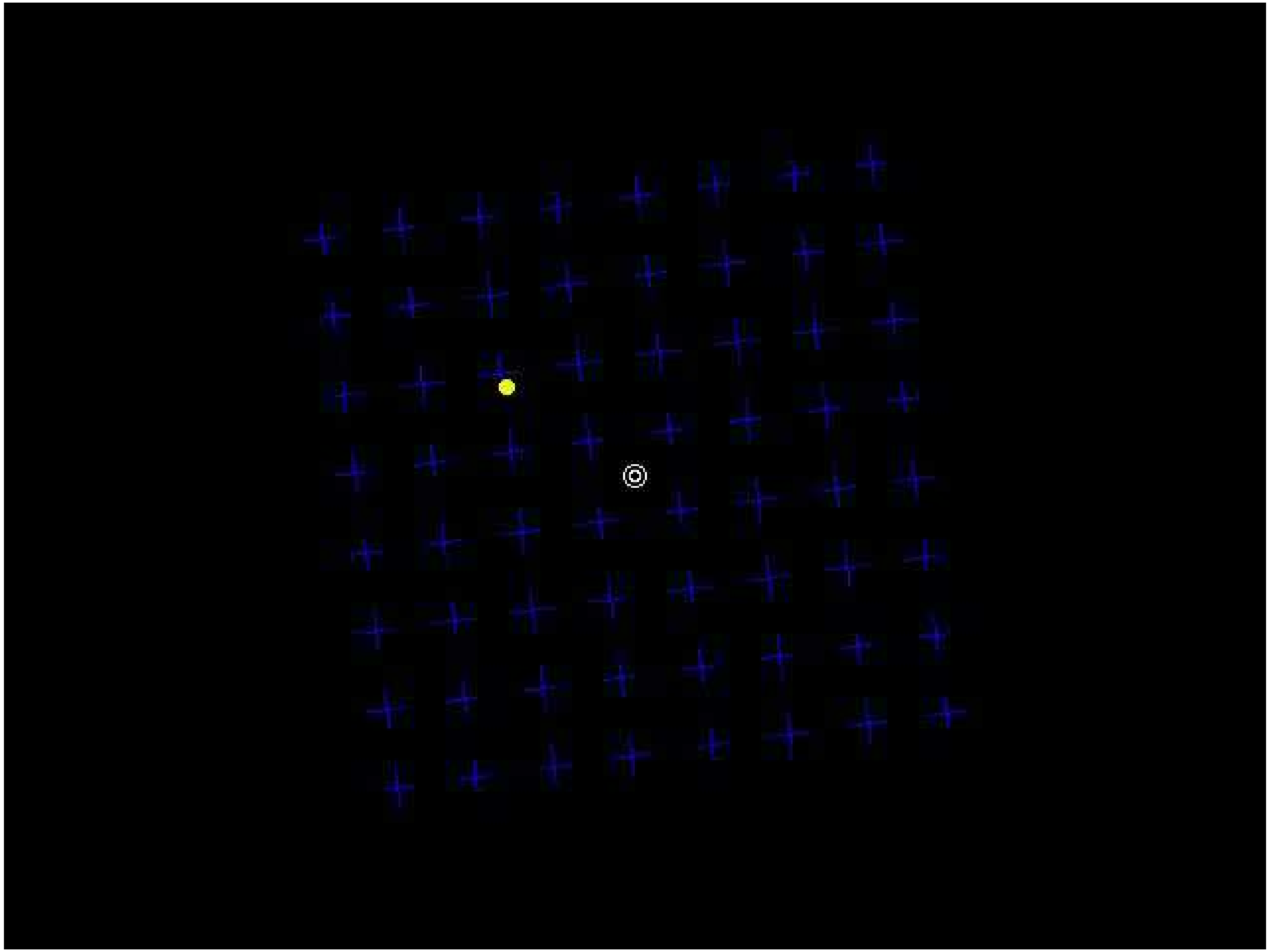
Observation:

In some visual scenes, parts of the image tend to disappear "apparently", although they do not actually disappear.



1. Introduction



History:

First described by Grindley and Townsend in 1965.

The name:

« Motion-Induced Blindness » aka MIB. (2001)

- *Motion*, because the likely cause is that the image changes,
- *Blindness*, as the consequence is an object disappears for the subject,
- *Induced*, for it is assumed that the movement that causes the apparent disappearance.

Explanations:

Bonneh, Cooperman & Sagi (2001): subjects do not see some objects due to a **loss of visual attention**.

Funk & Pettigrew (2003): the MIB results from the **rivalry between the right hemisphere and the left hemisphere**. The right hemisphere sees the world as it is, while the left hemisphere takes away the noise.

New & Scholl (2008): some objects disappear because the visual system think they are failures, called **scotomas**, and should therefore be corrected.

Bonneh (2010): theory of **microsaccades**, whose function is to reactivate the image on regular retinal receptors so that they do not interrupt the transmission of light signals to the brain.

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2. Experiment

Objectives:

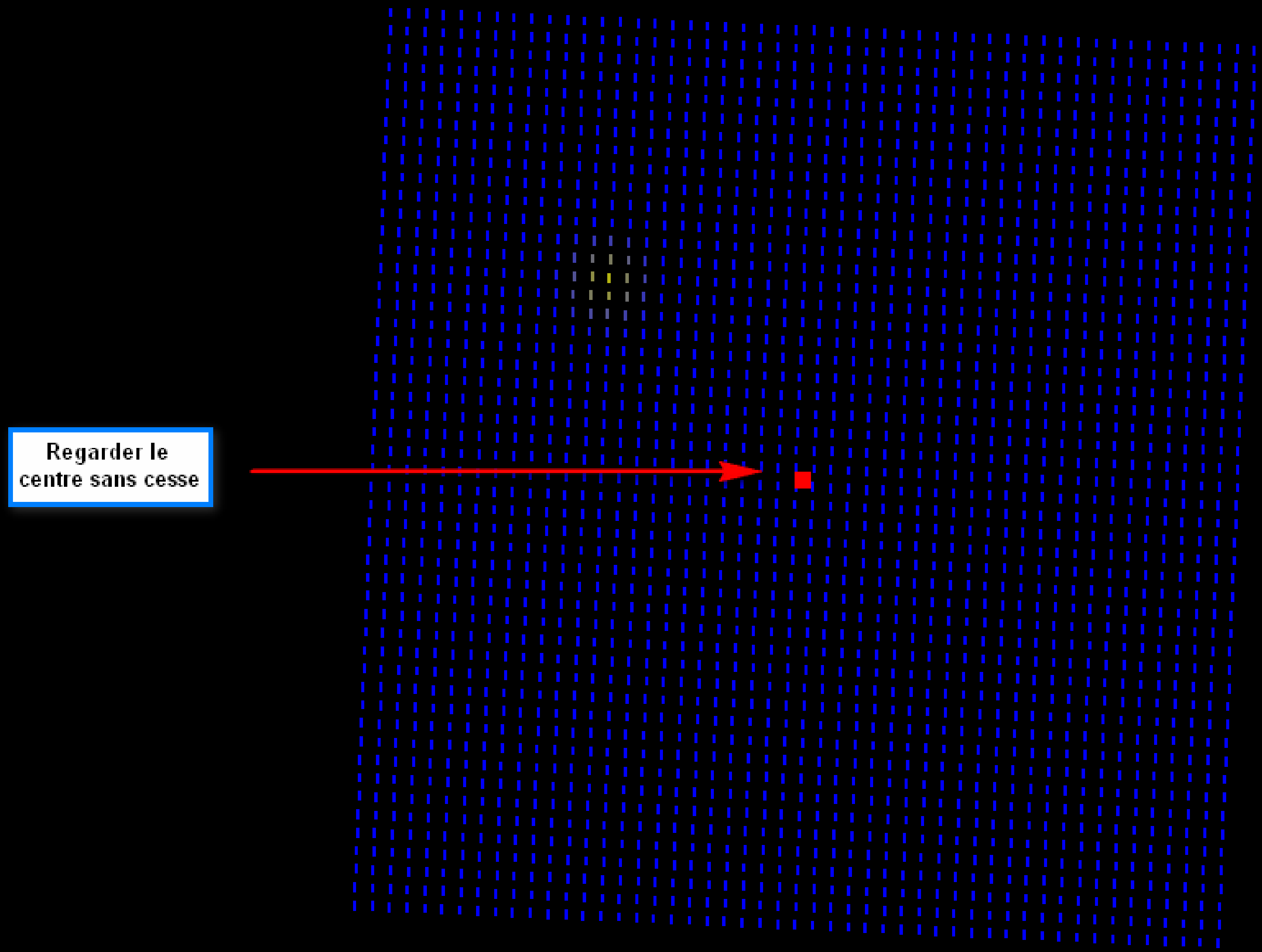
- Reproduce certain results of the reference papers on the MIB
- Analyze a few variants to quantify their impact on the MIB

2. Experiment

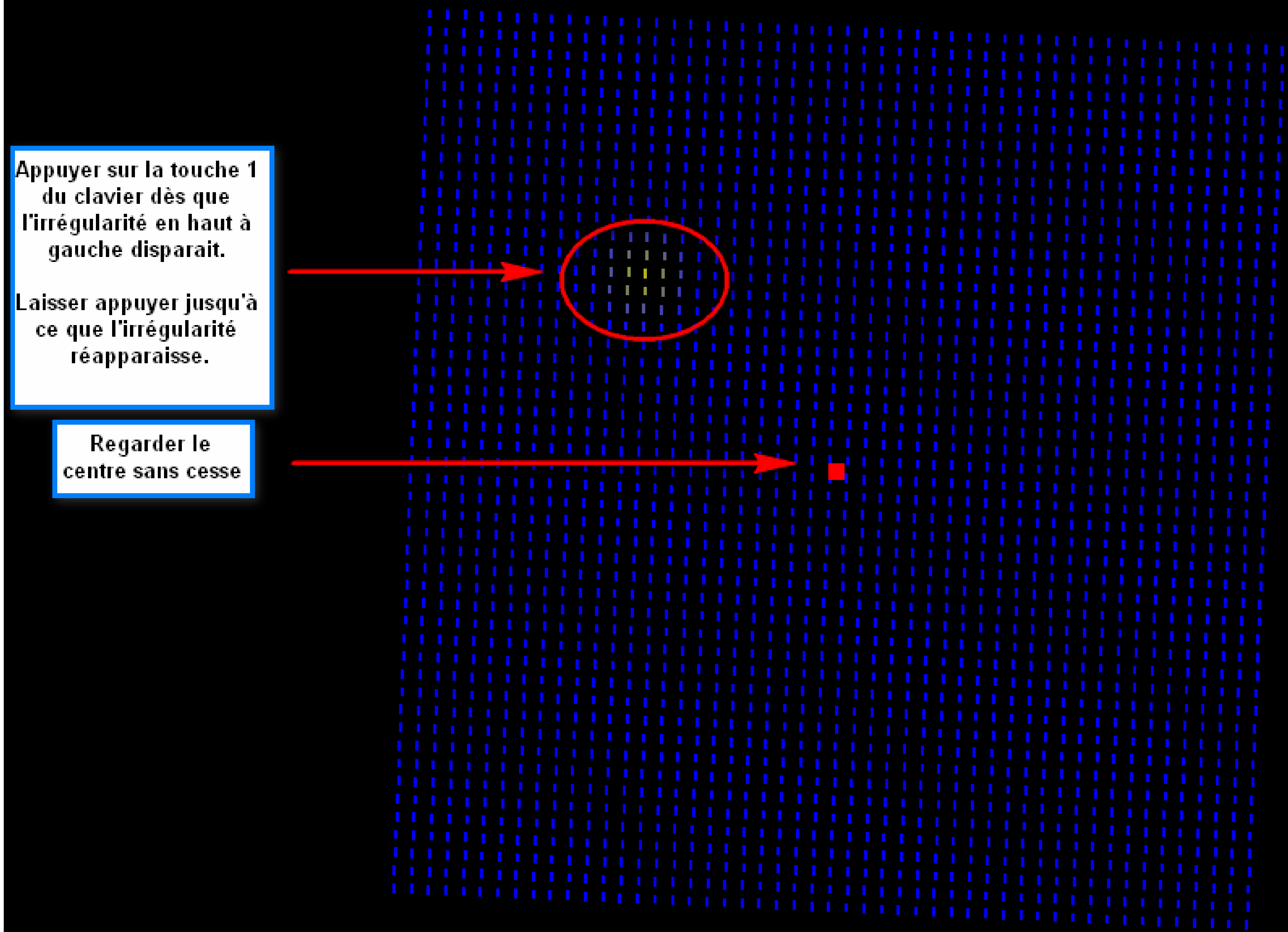
Protocol

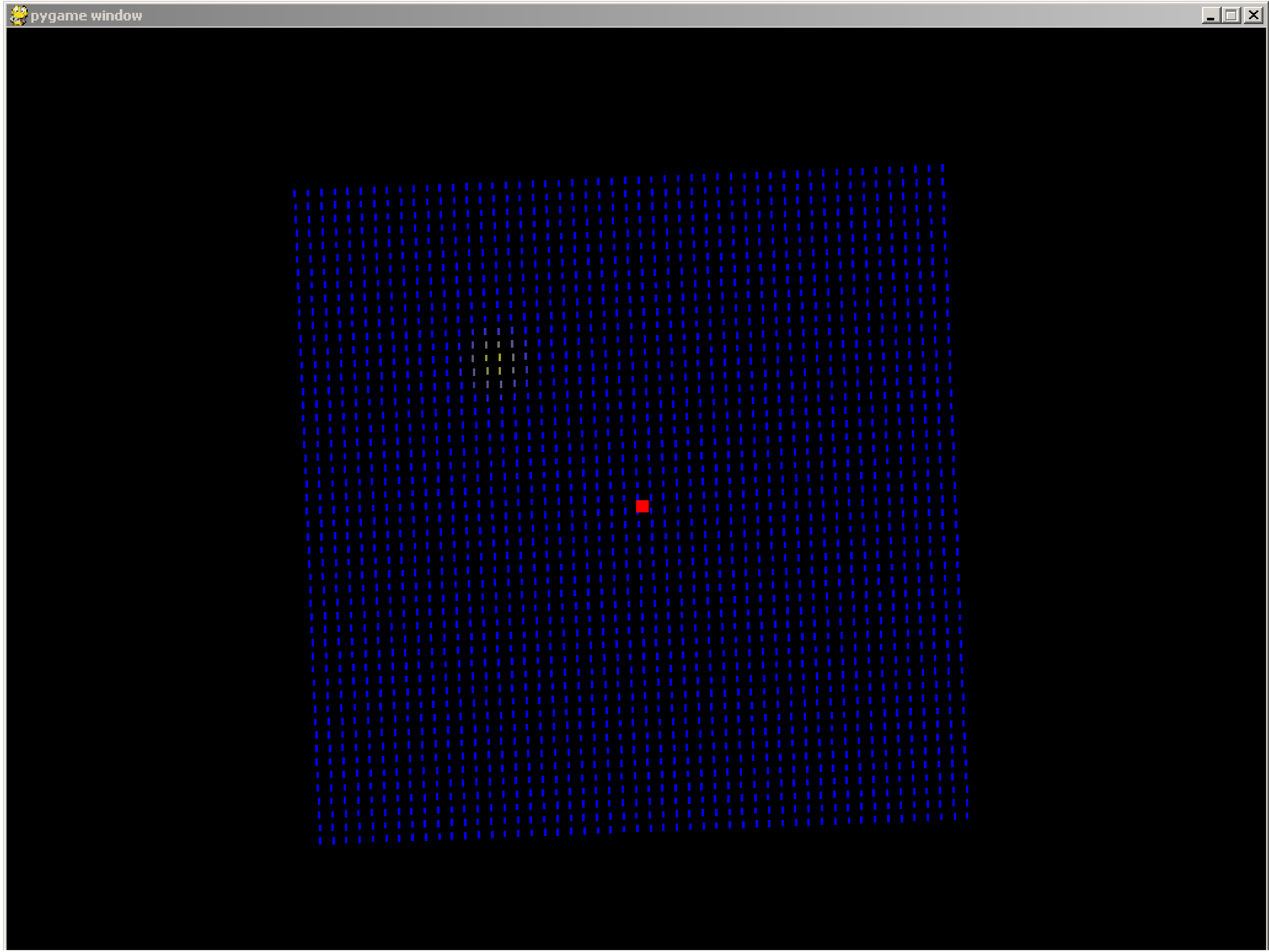
- Duration: ca. **20 minutes**.
- Composition: a couple of videos during each 30 seconds will be shown, each video is presented twice, all in random order.
- Task: for each video, the subject will look at the point in the center of the screen. An irregularity is present in the top left of the video: it may disappear from time to time. The subject presses a key on the keyboard as soon as it begins to disappear, and keeps it pushed down until the irregularity reappears.
- During the experiment, the first video will not be taken into account so as to allow the subject to get used to the task.
- Size: **20 subjects.** 10 for the main experiment, 2 groups of 5 subjects for the variations

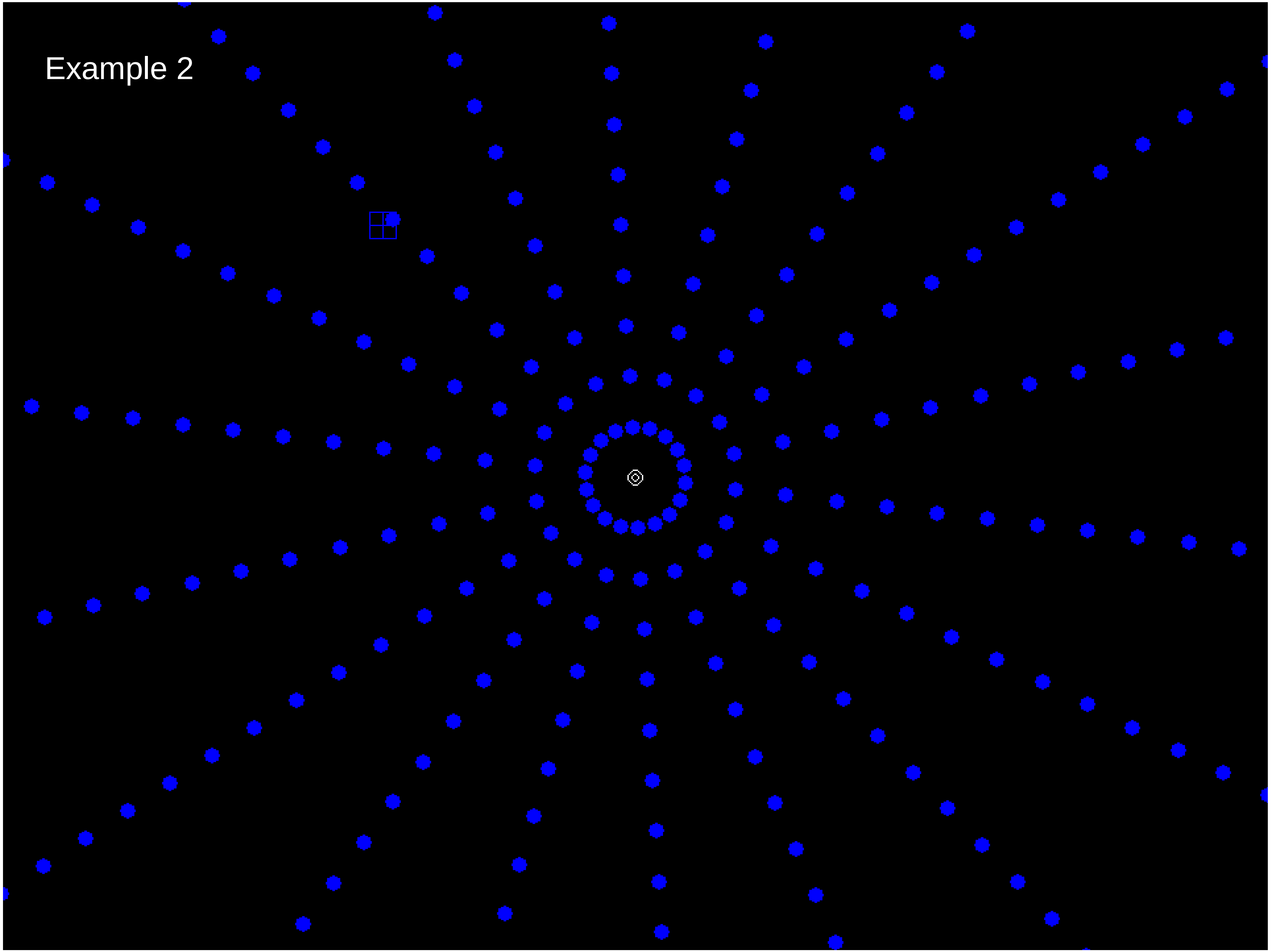
Example 1

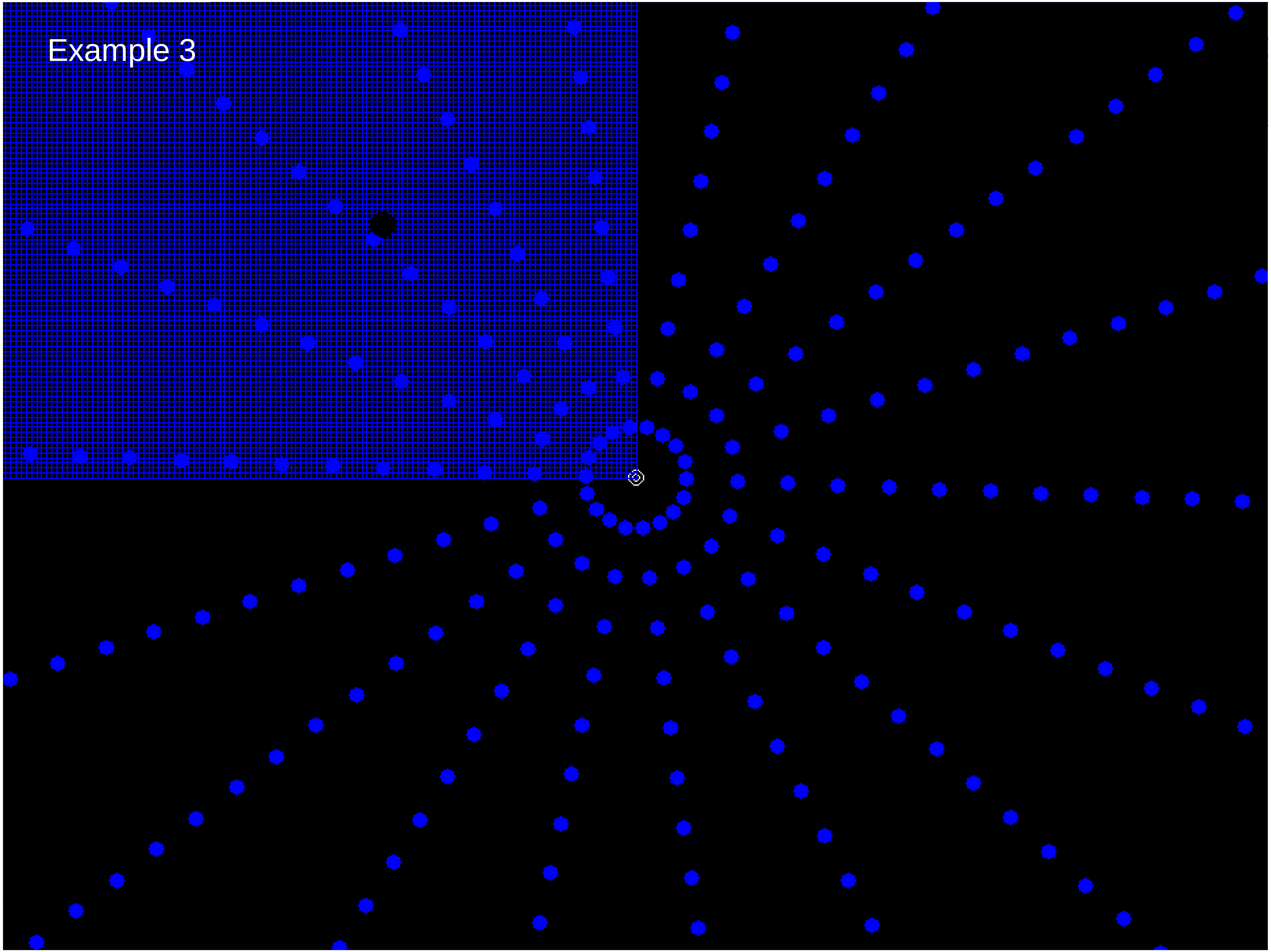


Example 1

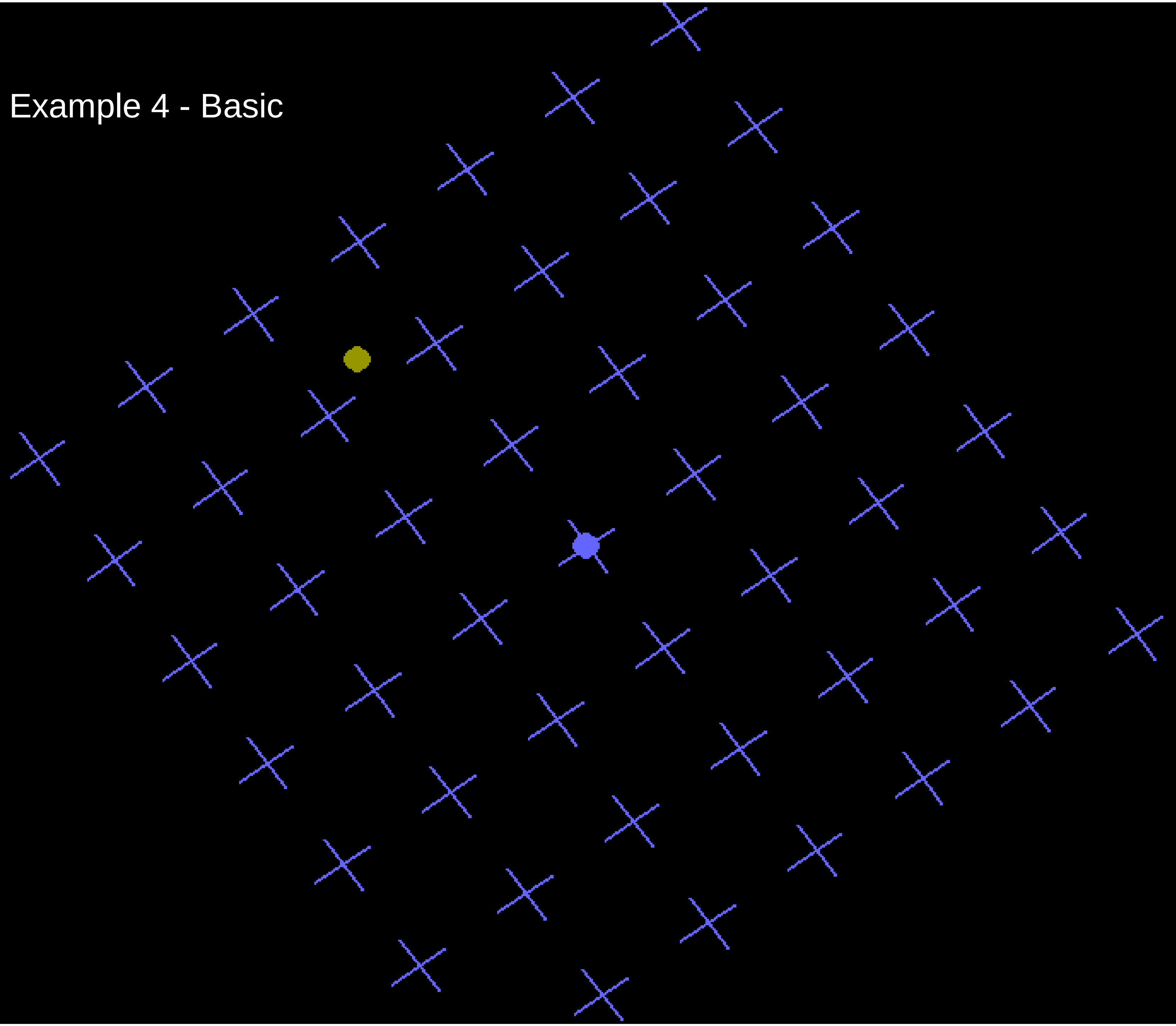

Appuyer sur la touche 1 du clavier dès que l'irrégularité en haut à gauche disparait.
Laisser appuyer jusqu'à ce que l'irrégularité réapparaisse.
Regarder le centre sans cesse


pygame window

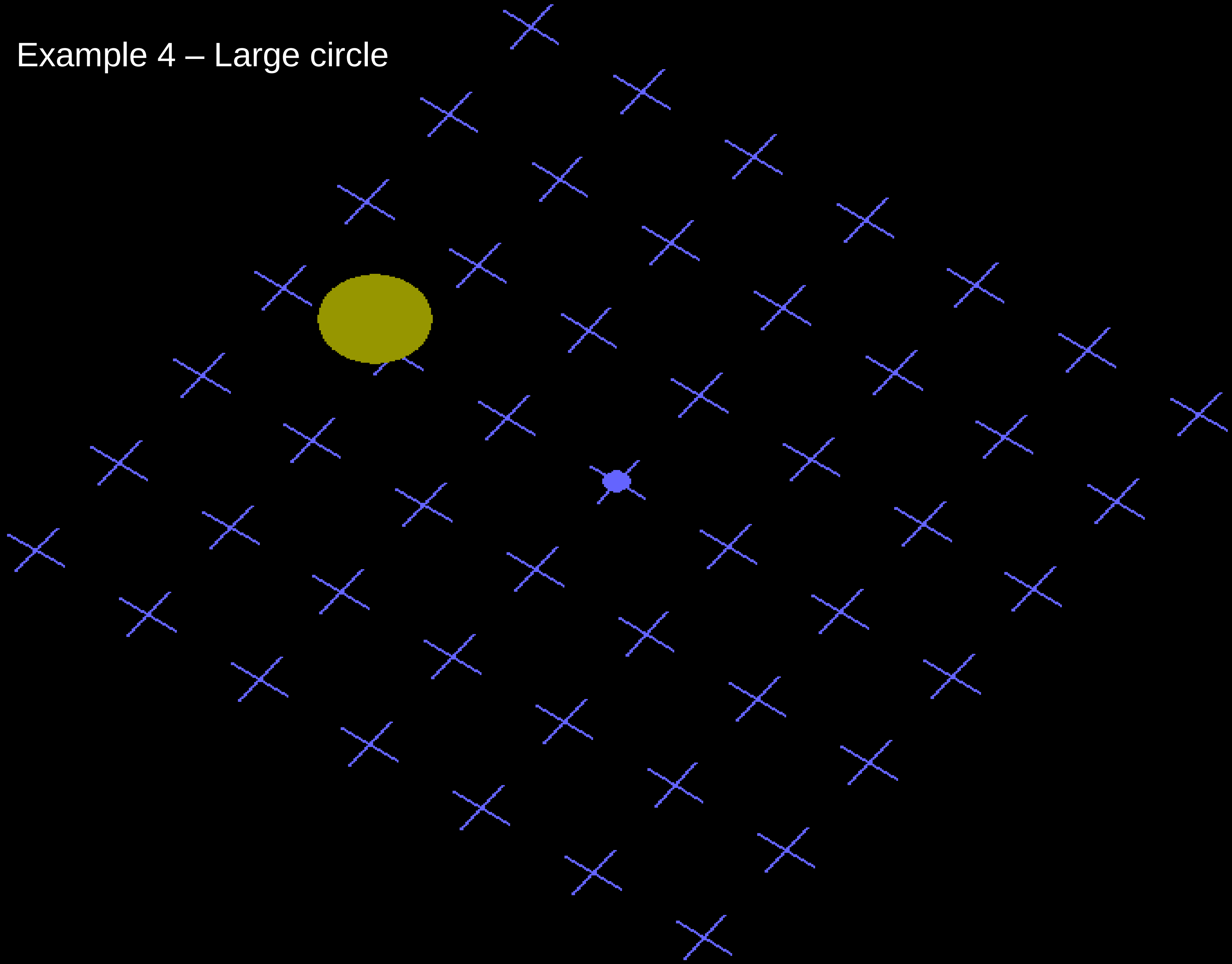

Example 2


Example 3

Example 4 - Basic



Example 4 – Large circle



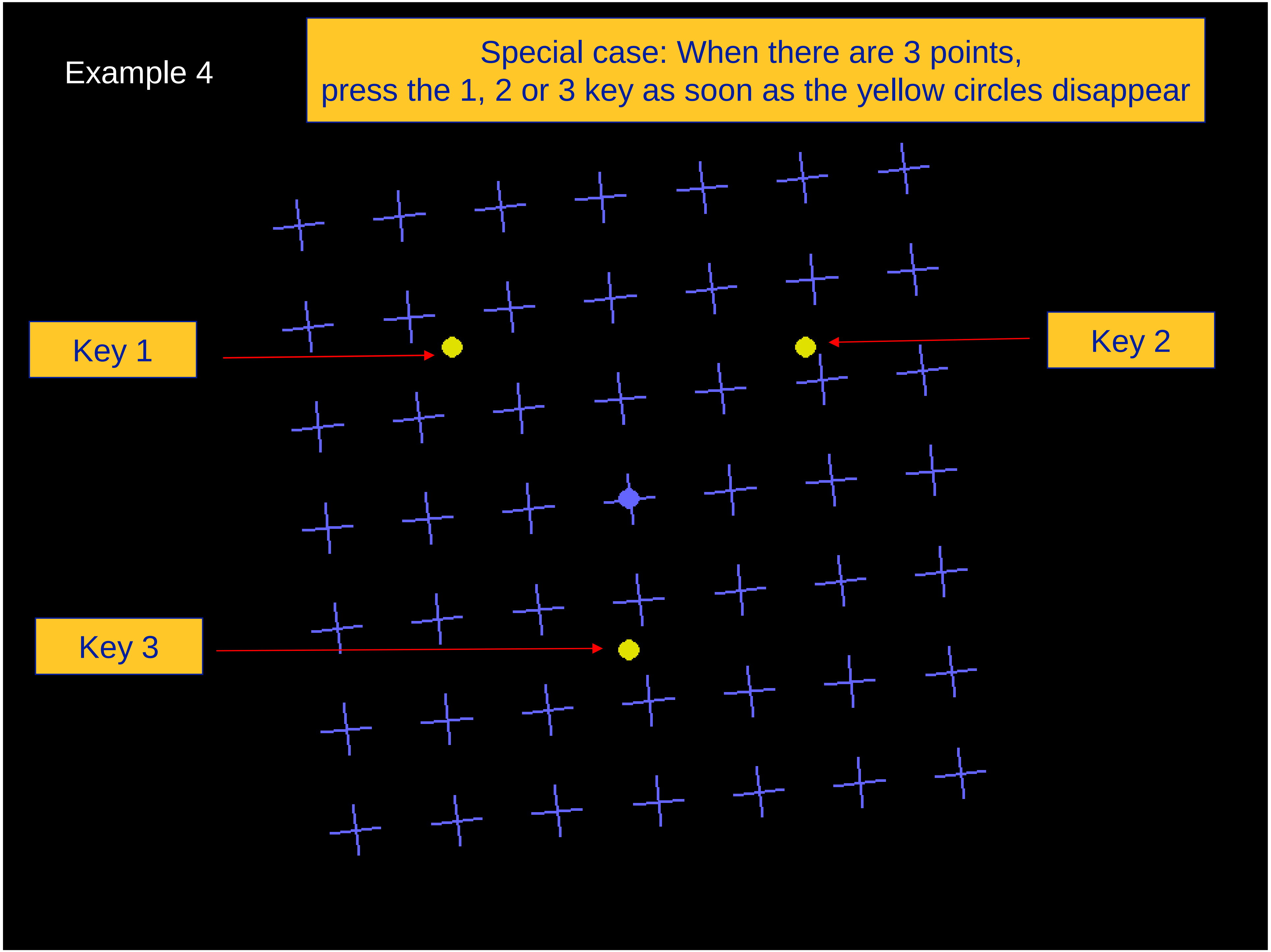
2. Experiment

Demo!

2. Experiment

2 variants:

1. Present 3 points to the subject
2. Actually remove the point when the subject no longer sees it!


Example 4
Special case: When there are 3 points,
press the 1, 2 or 3 key as soon as the yellow circles disappear
Key 1
Key 2
Key 3

2. Experiment

Programming the experiment:

- ✓ Language : Python (pygame)
- ✓ RCS : Git (https://github.com/FrankyRP/MIB)
- ✓ IDE : Eclipse (Pydev + EGIT)
- ✓ Compilation: py2exe, via the script pygame2exe.py

github SOCIAL CODING

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FrankyRP / MIB

Admin | Unwatch | Pull Request | 2 | 2

Source | Commits | Network | Pull Requests (0) | Fork Queue | Issues (0) | Wiki (0) | Graphs | Branch: master

Switch Branches (1) | Switch Tags (0) | Branch List

CogMaster - AE(a) Project - Motion-induced blindness — Read more

http://sites.google.com/site/exphum/projets/motion-induced-blindness

Downloads

SSH | HTTP | Git Read-Only | git@github.com:FrankyRP/MIB.git | This URL has **Read+Write** access

Add moving point in expl when mib is long.

FrankyRP (author)
about 11 hours ago

commit 71a5f4c6138b09141a58
tree 954da8cf9831bc57fac1
parent aa55b559130cc34f2ba2

MIB /

name	age	message	history
src/	about 11 hours ago	Add moving point in expl when mib is long. [FrankyRP]	
.project	December 19, 2010	test [FrankyRP]	
.pydevproject	December 26, 2010	First versions of: [FrankyRP]	
README	December 26, 2010	back to normal [FrankyRP]	

README

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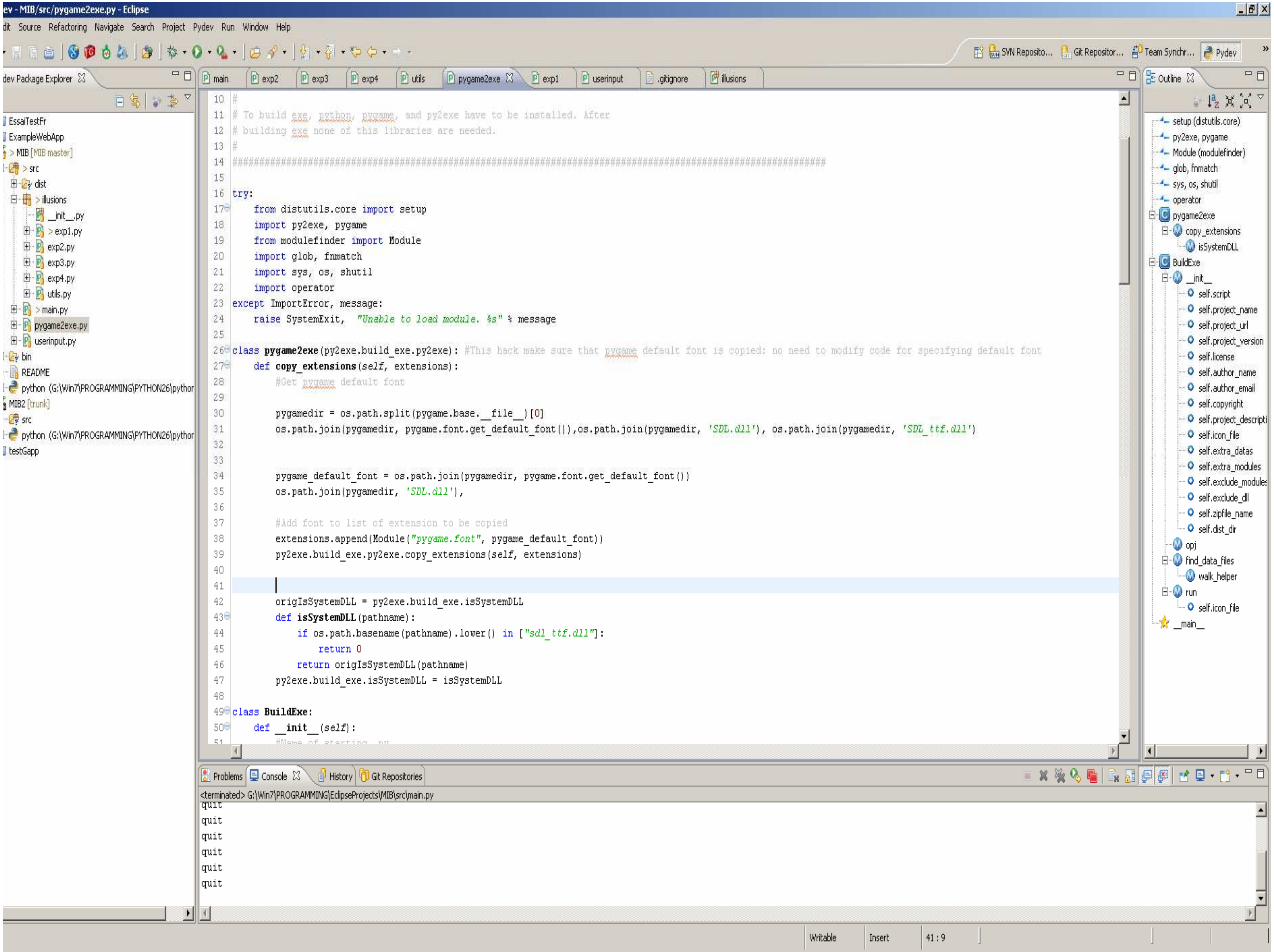
CogMaster 2010-2011 -> S1 -> AE(a)
Project MIB: http://sites.google.com/site/exphum/projets/motion-induced-blindness
```


ev - MIB/src/pygame2exe.py - Eclipse
dit Source Refactoring Navigate Search Project Pydev Run Window Help
SVN Reposito... Git Repositor... Team Synchr... Pydev
dev Package Explorer
main exp2 exp3 exp4 utils pygame2exe exp1 userinput .gitignore illusions
EssaiTestFr
ExampleWebApp
> MIB [MIB master]
> src
dist
> illusions
__init__.py
> exp1.py
exp2.py
exp3.py
exp4.py
utils.py
> main.py
pygame2exe.py
userinput.py
bin
README
python (G:\Win7\PROGRAMMING\PYTHON26\pythor
MIB2 [trunk]
src
python (G:\Win7\PROGRAMMING\PYTHON26\pythor
testGapp
#
To build exe, python, pygame, and py2exe have to be installed. After
building exe none of this libraries are needed.
#
##
try:
    from distutils.core import setup
    import py2exe, pygame
    from modulefinder import Module
    import glob, fnmatch
    import sys, os, shutil
    import operator
except ImportError, message:
    raise SystemExit, "Unable to load module. %s" % message
class pygame2exe(py2exe.build_exe.py2exe): #This hack make sure that pygame default font is copied: no need to modify code for specifying default font
    def copy_extensions(self, extensions):
        #Get pygame default font
        pygamedir = os.path.split(pygame.base.__file__)[0]
        os.path.join(pygamedir, pygame.font.get_default_font()),os.path.join(pygamedir, 'SDL.dll'), os.path.join(pygamedir, 'SDL_ttf.dll')
        pygame_default_font = os.path.join(pygamedir, pygame.font.get_default_font())
        os.path.join(pygamedir, 'SDL.dll'),
        #Add font to list of extension to be copied
        extensions.append(Module("pygame.font", pygame_default_font))
        py2exe.build_exe.py2exe.copy_extensions(self, extensions)
        origIsSystemDLL = py2exe.build_exe.isSystemDLL
        def isSystemDLL(pathname):
            if os.path.basename(pathname).lower() in ["sdl_ttf.dll"]:
                return 0
            return origIsSystemDLL(pathname)
        py2exe.build_exe.isSystemDLL = isSystemDLL
class BuildExe:
    def __init__(self):
Outline
setup (distutils.core)
py2exe, pygame
Module (modulefinder)
glob, fnmatch
sys, os, shutil
operator
pygame2exe
copy_extensions
isSystemDLL
BuildExe
__init__
self.script
self.project_name
self.project_url
self.project_version
self.license
self.author_name
self.author_email
self.copyright
self.project_descripti
self.icon_file
self.extra_datas
self.extra_modules
self.exclude_modules
self.exclude_dll
self.zipfile_name
self.dist_dir
opj
find_data_files
walk_helper
run
self.icon_file
__main__
Problems Console History Git Repositories
<terminated> G:\Win7\PROGRAMMING\EclipseProjects\MIB\src\main.py
quit
quit
quit
quit
quit
quit
Writable Insert 41 : 9

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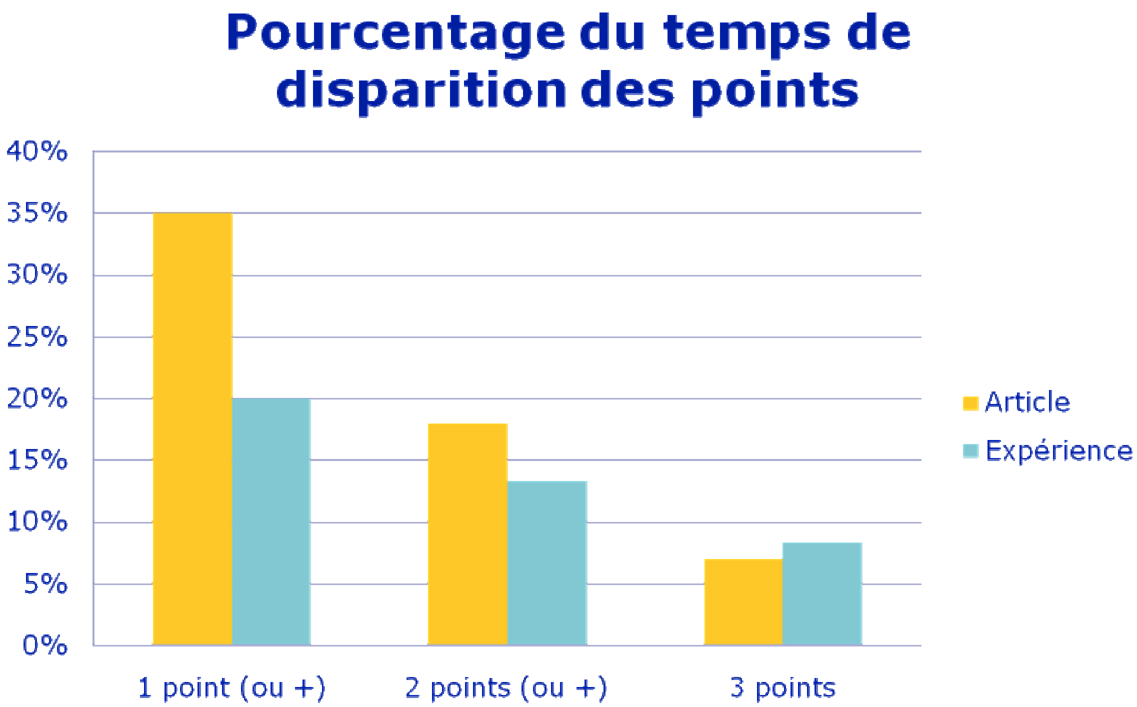
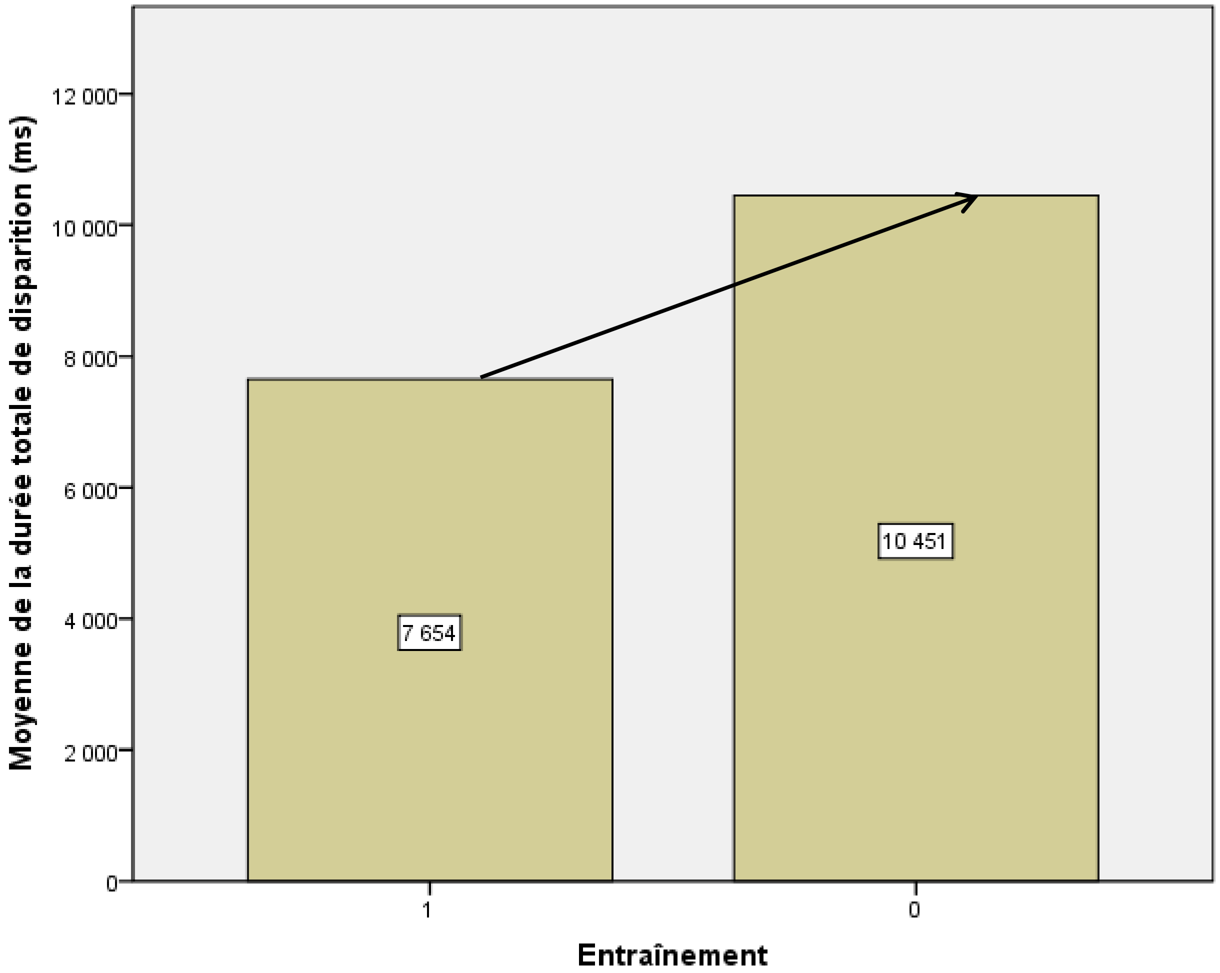
3. Results



Our results are different from those of the article Bonneh (2001) regarding the cumulative loss (1 point or +).

However, we get similar results for two points and more.

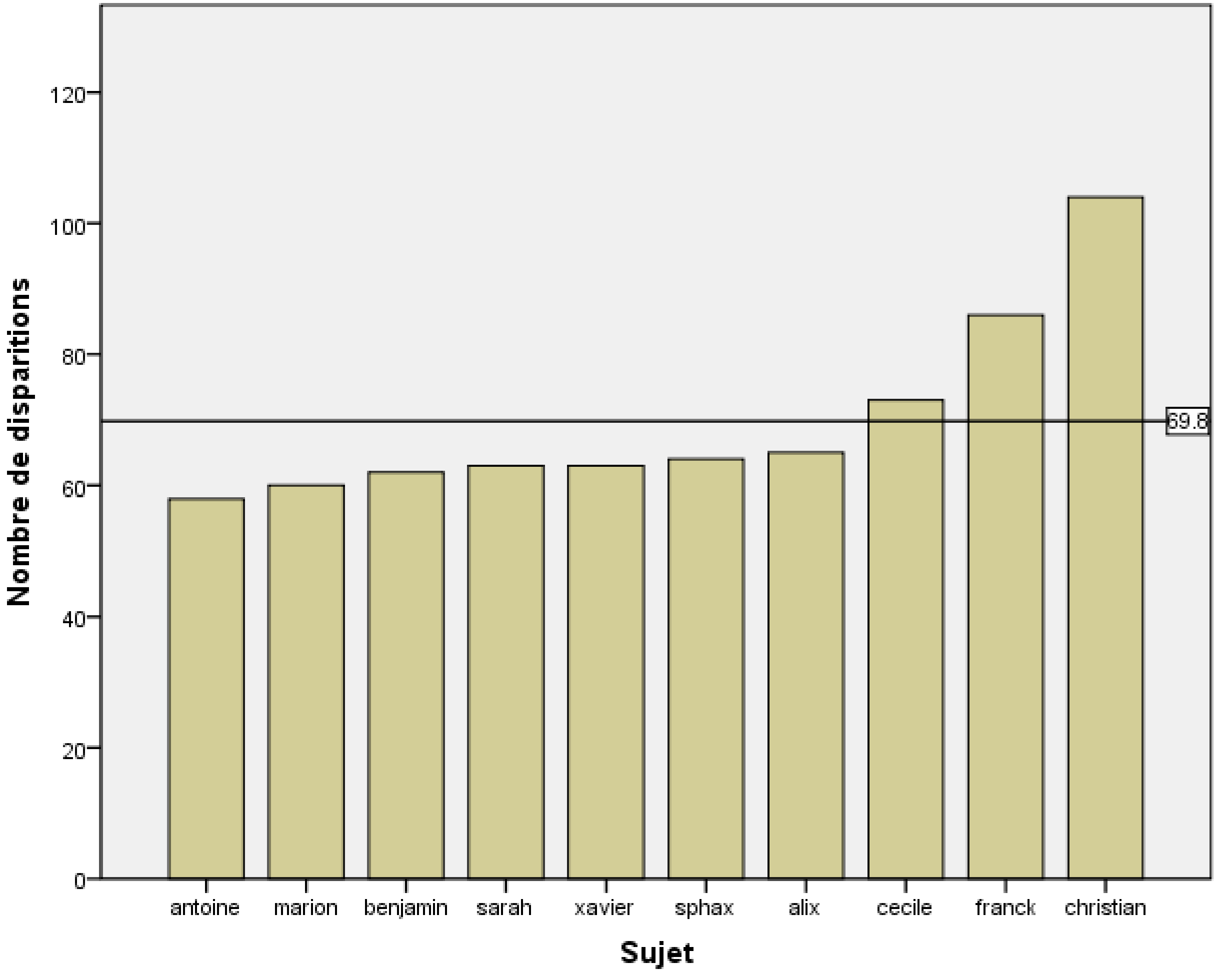
3. Results



We note that the average time of disappearance is 7.6 seconds for the training experience, against 10.5 seconds in the testing experience.

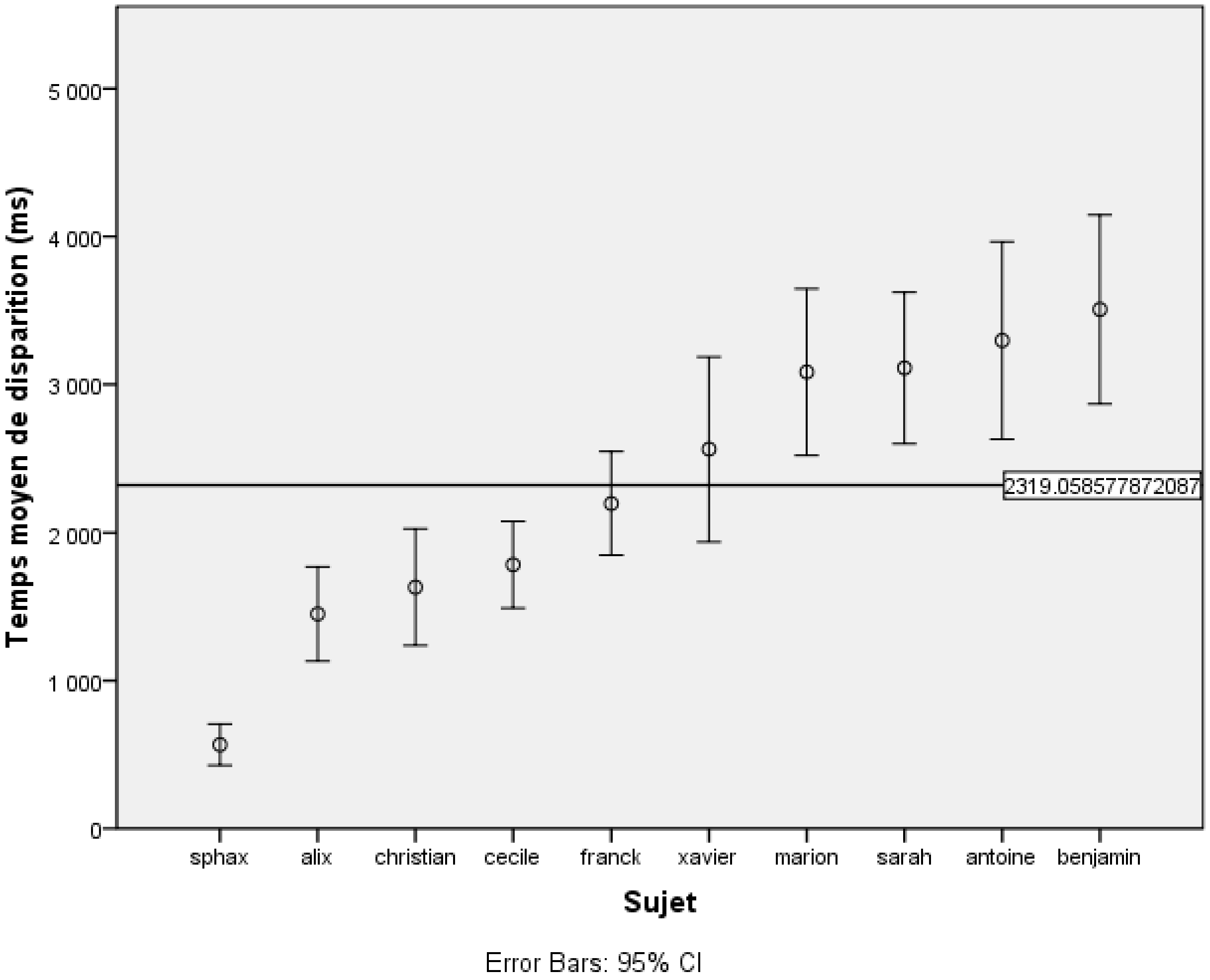
This shows that the training step does help the subject to get accustomed to the experience.

3. Results



The average number of disappearances is similar between subjects, with an average of 69.8 disappearances over the duration of the experiment.

3. Results

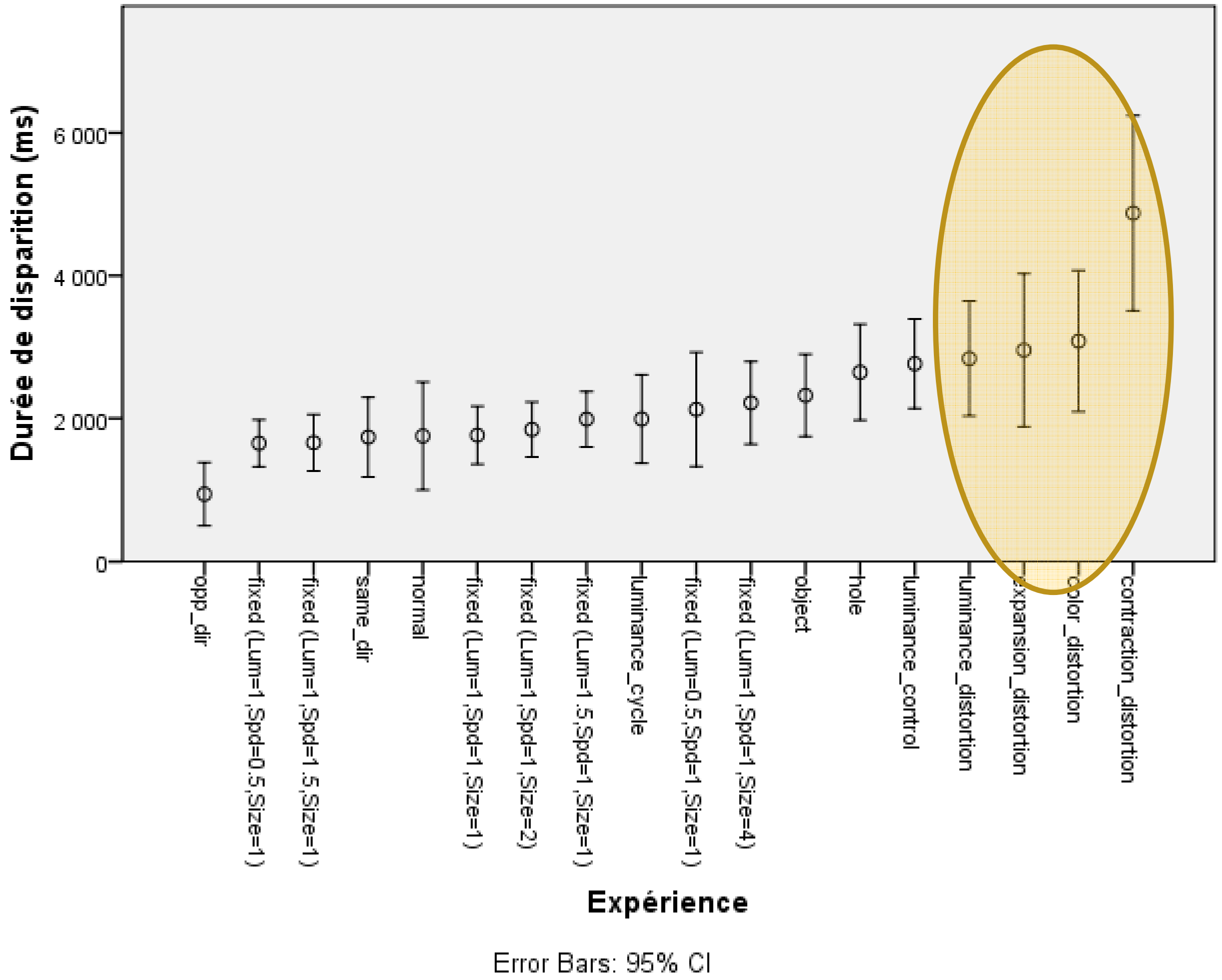


The durations of the disappearance of the stimuli and their distribution vary amongst the subjects:

> 5 have an average higher than the overall average (2.32s), and a standard deviation of 0.5s.

> 5 others are below average, with a standard deviation of 0.25s.

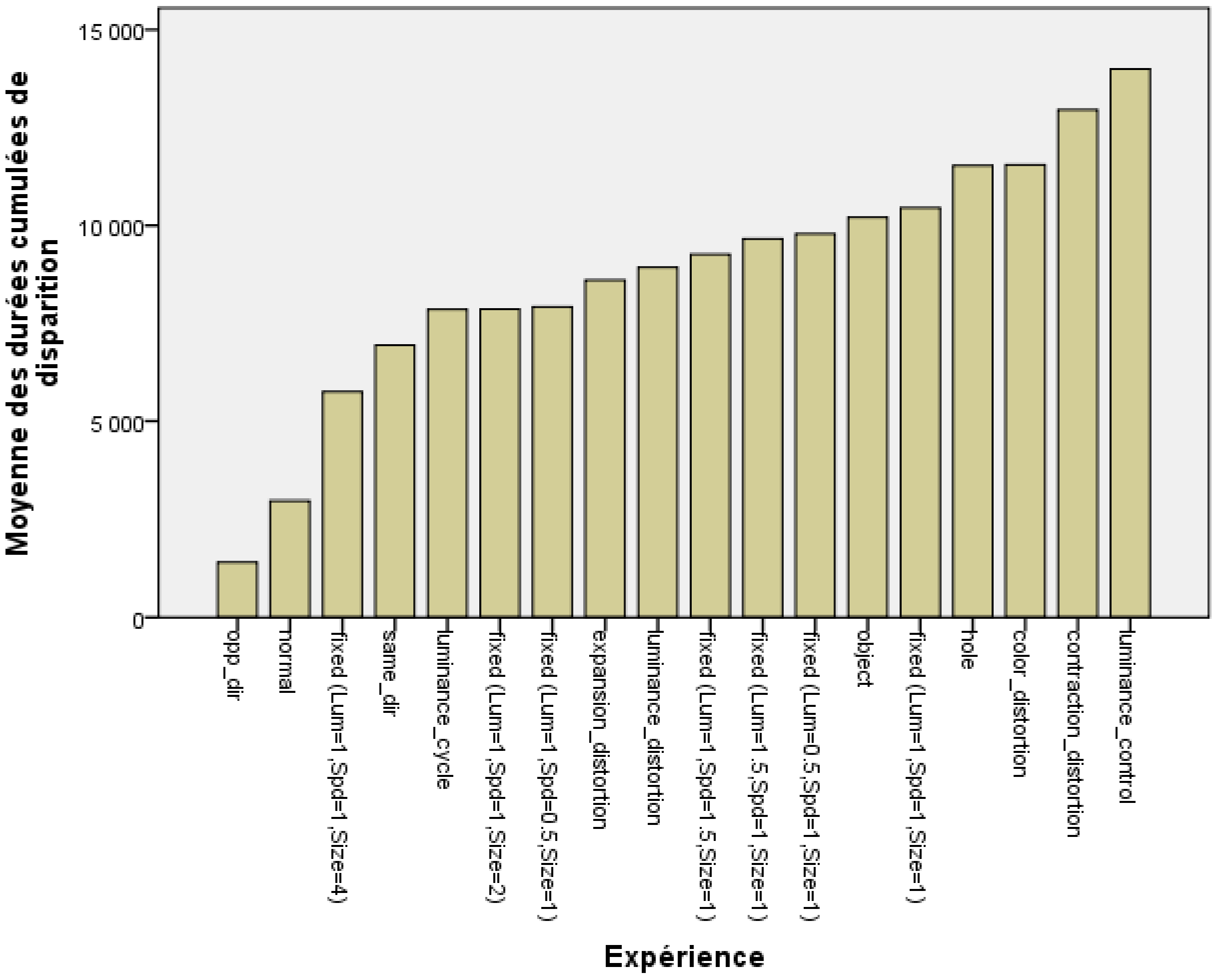
3. Results



2 experiments give atypical results: "contraction / distortion", with a larger mean and standard deviation and "opposite direction" with a lower average.

Other experiments give similar results: time of disappearance close to 2.2s, and standard deviation between 0.25s and 0.5s (note: the standard deviation of "fixed" is misleading because it focuses on more experiments). The experiments that do not involve the star give the best results.

3. Results

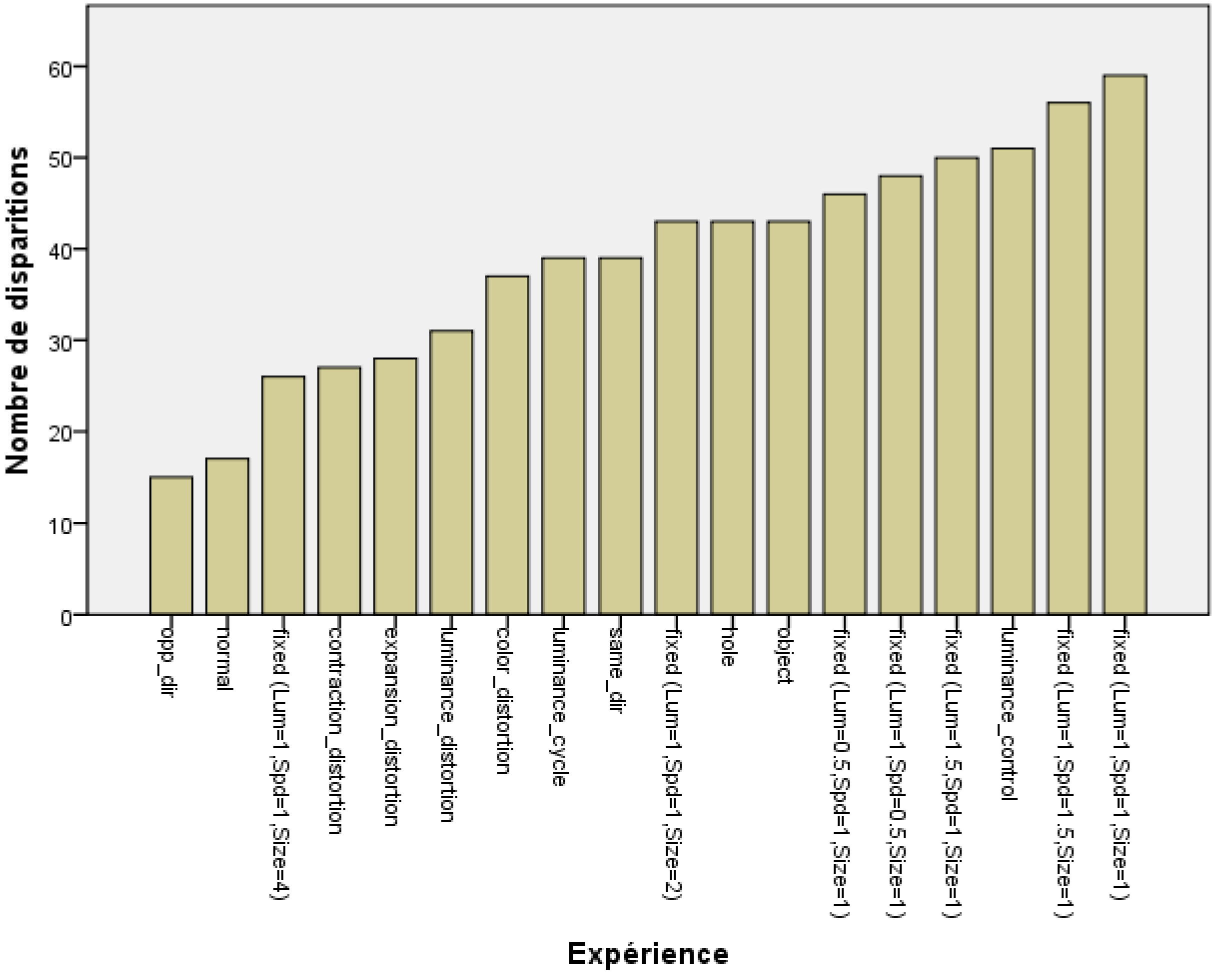


The duration of disappearances varies between 7s and 14s (remember that an experiment lasts 30s)

The experiments leading to the longest cumulative duration of disappearances are also those that do not relate to the star.

We find lower results, yet similar to our reference article.

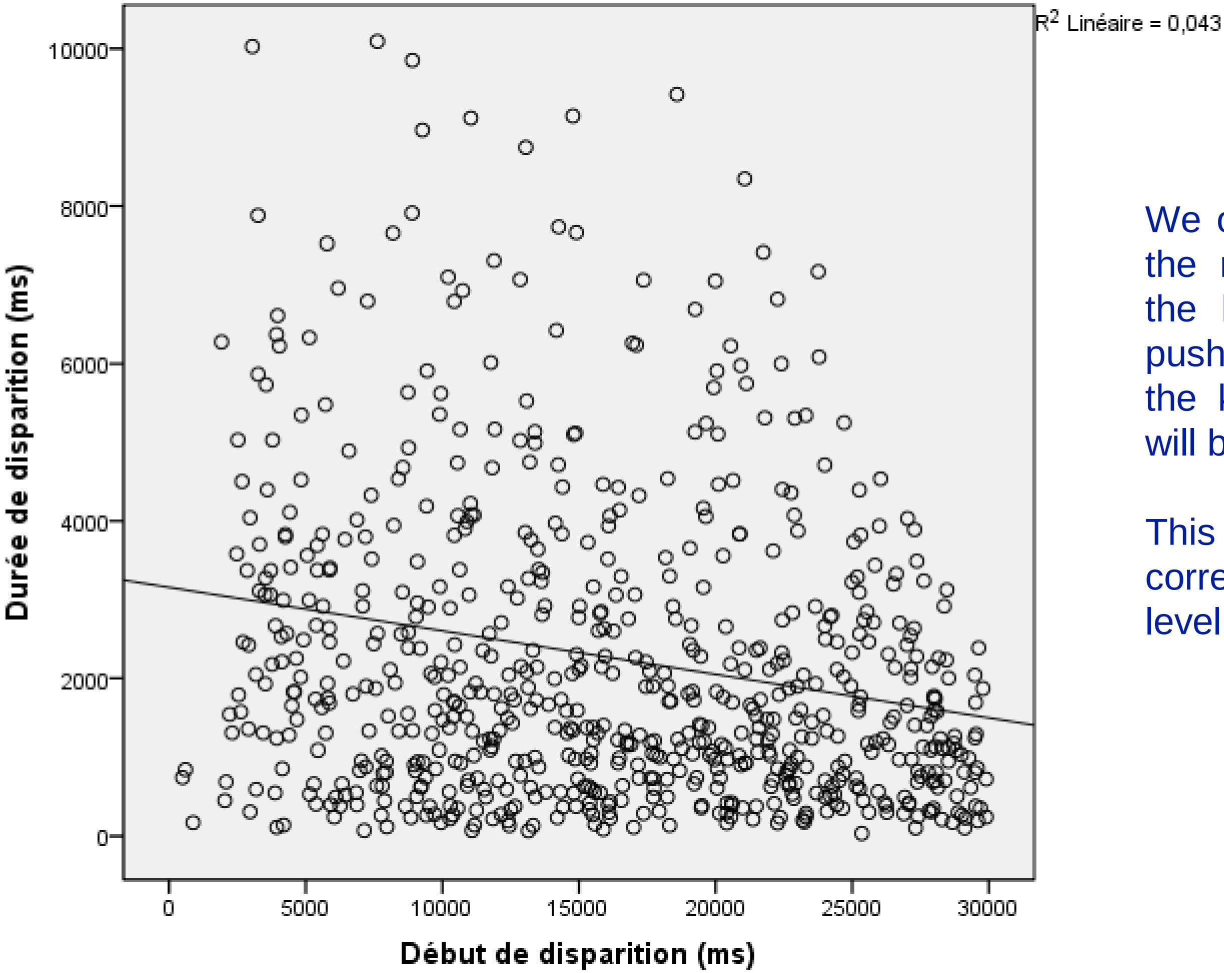
3. Results



Logically, the experiments that do not involve the star therefore cause the least number of disappearances, the latter being relatively long.

However, this proves that the effect takes longer to fire than others.

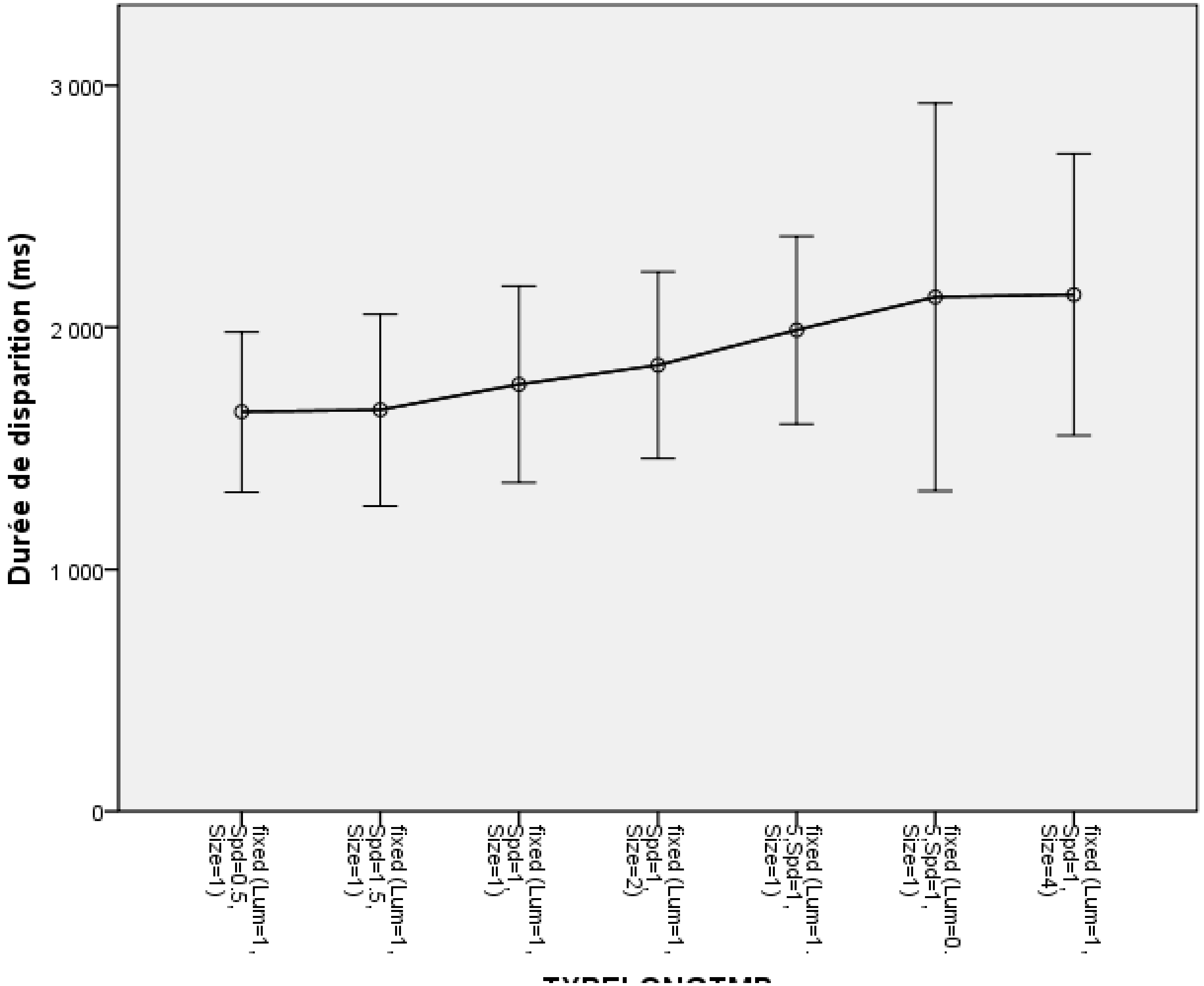
3. Results



We observe a slight correlation between the moment when the subject presses the key and the duration he keeps it pushed down. The later the subject hits the key, the shorter the disappearance will be.

This effect is yet subtle: the Pearson correlation coefficient with a confidence level of 0.01 is -0.207.

3. Results



In the variations of the initial experiment, we see that two factors increase the average time of disappearance of the stimulus: a larger size and lower brightness. Other changes diminish the effect.

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4. Conclusion

- We managed to replicate a large number of experiments and their variants (Bonneh 2001, 2010).

- We get results similar to those of the articles, although generally below.

- We have focused on experiments with a single stimulus rather than three, to ensure the accuracy of the results.

4. Conclusion

- We have proven the benefit of training the subject to the experiment.

- Experiments where the MIB effect is the most present are our experiments with distortion (color or brightness).

- As for the initial experience, a larger size or a lower brightness increase the effect

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5. Limitations of the study

- There are factors that we did not have the time to test:
  - Different positions of the stimulus
  - Actual disappearance of the stimulus
  - Moving the stimulus

- In addition, this experimental protocol does not allow us to explain the physiological basis of this effect. Validating the scotoma theory would require rather to develop a model.

- Finally, we would have needed tools for monitoring the vision to know where the subject's attention was to test the hypothesis of microsaccades.

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References:

- Bonneh Y, Cooperman A, Sagi D, (2001), Motion induced blindness in normal observers. Nature 411, 798 – 801
- Funk & Pettigrew (2003). Does interhemispheric competition mediate motion-induced blindness? A transcranial magnetic stimulation study. Perception, 32, 1328-1338.
- Kim, C.Y., and Blake, R. (2005) Psychophysical magic: rendering the visible 'invisible'. Trends Cogn Sci 9, 381-388
- Mitroff, S. R. & Scholl, B. J. (2005). Forming and updating object representations without awareness: Evidence from motion-induced blindness. Vision Research, 45(8), 961-967.
- New JJ, Scholl BJ (2008), “Perceptual Scotomas” A functional account of motion-induced blindness. Psychological Science 19(7):653–659
- Bonneh YS, Donner TH, Sagi D, Fried M, Heeger DJ & Arieli A. 2010. Microsaccades and Motion-induced Blindness: Cause and Effect. Journal of Vision, 10; doi:10.1167/10.14.22.


franck.dernoncourt@gmail.com