

功能性近紅外光實驗實作

fNIRS Experiment Practice

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本週課程內容

- Visual/Auditory Stimulation: Presentation
 - <https://www.neurobs.com/>
- Experiment Practice
 - Motor task
 - Oddball task

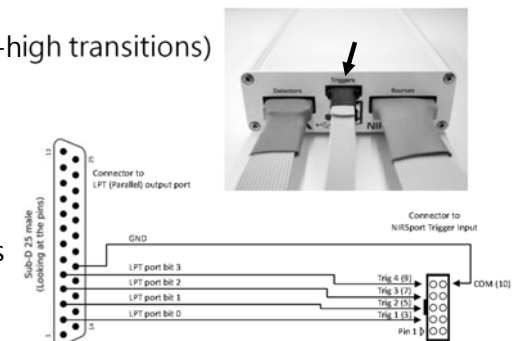
Please download the materials_L10.zip from
http://www.ym.edu.tw/~cflu/CFLu_course_fnirs.html

任務刺激給予

Presentation software

fNIRS stimulus

- Logic level
 - Positive edge triggered (low-to-high transitions)
- Minimum pulse duration
 - At least 10 ms long
- Maximum pulse duration
 - No restriction
 - Pulse separation at least 200 ms



Presentation software

neurobehavioralsystems <https://www.neurobs.com/>

Presentation

Precise, Powerful Stimulus Delivery



Presentation® is a stimulus delivery and experimental control program for neuroscience. It runs on any Windows PC, and delivers auditory, visual and multimodal stimuli with sub-millisecond temporal precision. Presentation is powerful enough to handle almost any behavioral, psychological or physiological experiment using fMRI, ERP, MEG, psychophysics, eye movements, single neuron recording, reaction time measures, other performance measures, and more.

Presentation is the world's most popular experimental control software with 76931 registrations and 171776 downloads, and counting.

[More Information](#)

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Presentation Documents

https://www.neurobs.com/presentation/docs/index_html

What's New	Specific features that are new in this version of Presentation
Introduction	If you don't know what Presentation is or if it will satisfy your needs, read this section
Presentation	The Main documentation for all Presentation features
Reference	If you already know what you're doing but need to look up details of specific features, you can do so here
Tutorials	This section contains tutorials about how to use Presentation
Introduction to Programming	This section and the following section are meant to be used as companion textbook while learning to program in Presentation
Copyright Information	Rights and permissions associated with Presentation

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Basic Structure

- Experiment (*.exp)
 - Directory pathway (Logfiles, Scenarios)
 - Hardware settings (Video, Audio, Response, Port)
 - Scenarios (at least one scenario)
- Scenario (*.sce)
 - Scenario Description Language (SDL)
 - Presentation Control Language (PCL) - optional

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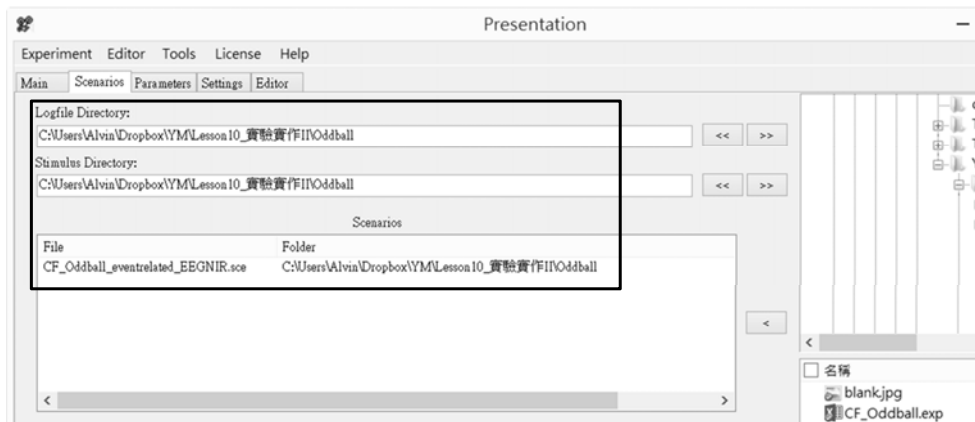
Experiment Setup

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Experiment Setup

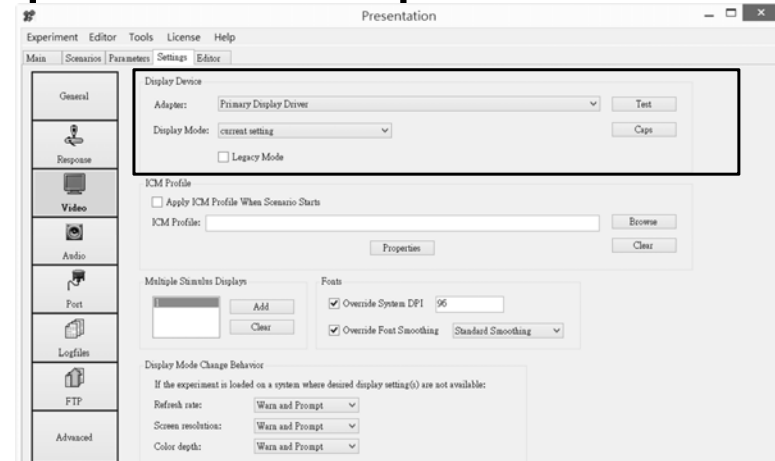


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Experiment Setup

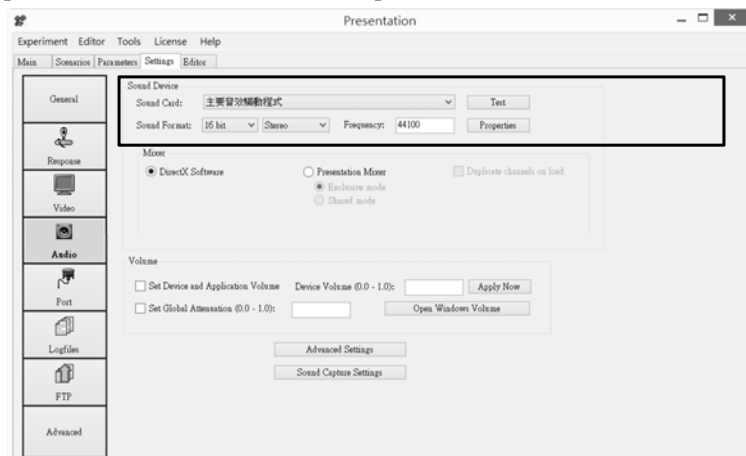


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Experiment Setup

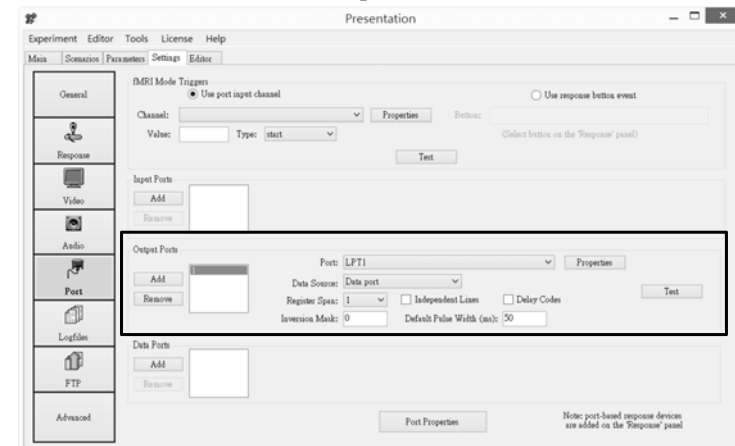


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Experiment Setup



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Scenario Structure

- File header
 - Parameters that affect the scenario as a whole
- SDL part
 - Single scenario file with repeated structures
 - Application with template files (*.tem)
- PCL part (optional)
- #: notation line
- Each line/statement must end with ;

Scenario Structure

```

1  |# Author: Lu, Chia-Feng 2015.05.06
2  |scenario="CF_Oddball_eventrelated_fNIR";
3  |scenario_type=trials;
4
5  |write_codes=true;
6  |default_output_port = 1;
7  |pulse_width = 50;
8
9  |default_deltat = 1600;
10
11 |#----- stimulus files pathway
12
13 |begin;      # begin-SDL marker
14 |picture {} default;
15
16 |picture { bitmap { filename = "resting_fix.jpg"; system_memory = true; }; x = 0
17 |picture { bitmap { filename = "blank.jpg"; system_memory = true; }; x = 0; y =
18 |picture { bitmap { filename = "end.jpg"; system_memory = true; }; x = 0; y = 0;
19 |wavefile {filename = "tone_1000Hz.wav";}tone1000Hz;
20 |wavefile {filename = "tone_2000Hz.wav";}tone2000Hz;
21 |sound {wavefile "tone1000Hz";} sound_tone1000Hz;
22 |sound {wavefile "tone2000Hz";} sound_tone2000Hz;
    
```

File header (lines 1-12)

SDL part (declare objects) (lines 13-22)

Scenario Structure

```

24 |#----- deliver stimuli by orders
25 |$nepoch = 12; # number of epochs
26 |$nminpresti = 3; # minimal number of pre-stimulus tones
27 |$nmaxpresti = 6; # maximal number of pre-stimulus tones
28 |$npoststi = 10; # number of post-stimulus tones
29
30
31 |LOOP $j $nepoch; # j=0,1,...,$nepoch-1
32 |   $random_npresti = '$nminpresti + int($random_value * ($nmaxpr-
33 |   trial{
34 |     picture "resting";
35 |     time = 0; code=0;
36
37 |     sound "sound_tone1000Hz";
38 |     time = 1500; port_code=1; code=1;
39 |   };
40
41 |LOOP $k $random_npresti; # k=0,1,...,$random_npresti-1
42 |   trial{
43 |     picture "resting";
44 |     time = 0; code=0;
45
46 |     sound "sound_tone1000Hz";
47 |     time = 1500; port_code=1; code=1;
48 |   };
49 |ENDLOOP;
50
51 |trial{
52 |   picture "resting";
    
```

SDL part (arrange trials) (lines 31-52)

File Headers

- Header parameters
- Parameter List

```

scenario="CF_Oddball_eventrelated_NIR";
scenario_type=trials;

write_codes=true;
default_output_port = 1;
pulse_width = 50;
    
```

active_buttons - antialias - back_clip_distance - button_codes - channels_bits_per_sample_sampling_rate - code_delay - default_all_responses - default_attenuation - default_background_color - default_clear_active_stimuli - default_cue_events - default_cue_event_port - default_default_2d_on_top - default_deltat - default_delta_time - default_draw_mode - default_font - default_font_size - default_formatted_text - default_invert_caption - default_max_responses - default_monitor_sounds - default_monitor_videos - default_optimize - default_output_port - default_pan - default_path - default_picture_duration - default_stimulus_time_in - default_stimulus_time_out - default_text_align - default_text_color - default_trial_duration - default_trial_start_delay - default_trial_type - default_volume - event_code_delimiter - field_of_view - front_clip_distance - no_logfile - pcl_file - pulse_code - pulse_out - pulse_value - pulse_width - pulses_per_scan - randomize_trials - response_logging - response_matching - response_port_output - scan_period - scenario - scenario_type - screen_width_distance - screen_height_distance - screen_distance_max_y - screen_width screen_height screen_bit_depth - sequence_interrupt - stimulus_properties - target_button_codes - write_codes

Scenario Objects

- Components of stimuli
 - picture
 - bitmap, text
 - sound
 - wavefile
 - Video (*.avi, *.mpg,...)
 - Trial
 - stimulus_event

Declare Objects

- Use {} to declare the contents of object
- Use " " to define strings

```
9 #----- stimulus files pathway
10
11 begin; # begin-SDL marker
12 picture {} default;
13
14 picture {bitmap { filename = "resting_fix.jpg"; system_memory = true; }; x = 0; y = 0; }resting;
15 sound {wavefile {filename = "tone_1000Hz.wav";}} sound_tone1000Hz;
16 sound {wavefile {filename = "standby.wav";}} sound_standby;
17 sound {wavefile {filename = "up.wav";}} sound_up;
18 sound {wavefile {filename = "down.wav";}} sound_down;
19 sound {wavefile {filename = "stop.wav";}} sound_stop;
```

Object name



Trial

- Stimulus events
 - picture
 - sound
 - video

 - time
 - port_code
 - code
 - trial_duration

```
38 trial{
39     sound "sound_up"; # up
40     time = 1000;
41     port_code=1;
42     code=1;
43 };
```

```
29 trial{
30     trial_duration=2000;
31     picture "instruction_left";
32     time=0;
33     code=2;
34 };
```

Template Files

Single scenario

```
trial {
  picture default;
  time = 0;

  picture pic4;
  time = 1000;
  code = "tree";
  target_button = 1;
};
trial {
  picture default;
  time = 0;

  picture pic2;
  time = 800;
  code = "horse";
  target_button = 3;
};
trial {
  picture default;
  time = 0;

  picture pic6;
  time = 1200;
  code = "rose";
  target_button = 1;
};
...
```

Template file

```
# filename: main.tem
trial {
  picture default;
  time = 0;

  picture $pic;
  time = $isi;
  target_button = $tbutton;
  code = $code;
};
```

Scenario file

```
TEMPLATE "main.tem" { # template definition
  pic      ecode  isi  tbutton ;
  pic4     "tree" 1000 1   ;
  pic2     "horse" 800  3   ;
  pic6     "rose" 1200 1   ;
  ...
};
```

Flow Control

- LOOP
 - Repeat trials
- IF
 - Discriminate events

```
43 LOOP $k 3; # k=0,1,...,2
44   trial{
45     sound "sound_tone1000Hz";
46     time = 1000;
47   };
48 ENDLLOOP;
```

```
81   IF '$j==8';
82     picture "instruction_left"; time=0; code=2;
83   ENDF;
84
85   IF '$j==1';
86     picture "instruction_right"; time=0; code=4;
87   ENDF;
```

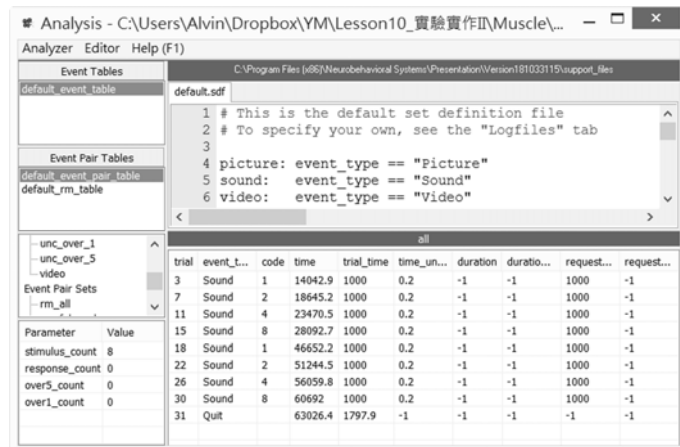
Mathematical Expressions

```
24 trial{
25   $random_intstruction = '25500 + int($random_value * 1500)';
26   trial_duration=$random_intstruction;
27   picture "resting"; time=0; code=0;
28 };
```

- \$random_value: generate a random number between 0 and 1

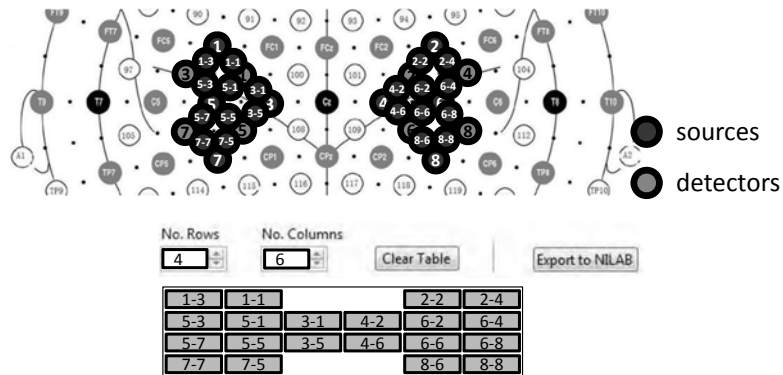
int(d)	converts d to an integer by dropping any decimal part	tan(d)	the tangent of d; d is in radians; d must be in the domain of tan()
abs(d)	the absolute value of d	acos(d)	the inverse cosine of d; d must be in the domain [-1,1]; range is [0, pi]
ceil(d)	the smallest integer greater than or equal to d	asin(d)	the inverse sine of d; d must be in the domain [-1,1]; range is [-pi/2, pi/2]
floor(d)	the largest integer less than or equal to d	atan(d)	the inverse tangent of d; range is [-pi/2, pi/2]
sqrt(d)	the square root of d; d must be non-negative	exp(d)	the exponential of d
cos(d)	the cosine of d; d is in radians	log(d)	the log base e of d; d must be positive
sin(d)	the sine of d; d is in radians	log10(d)	the log base 10 of d; d must be positive

Logfile (*.log)



實驗實作 Experiment Practice

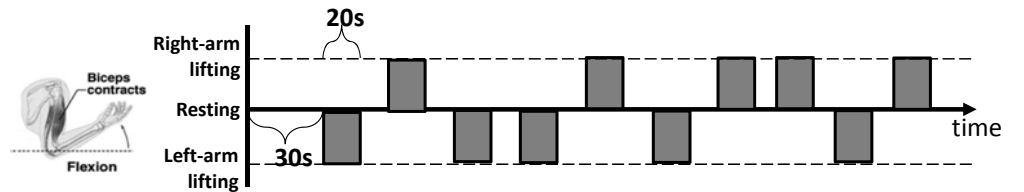
Bilateral Arm lifting



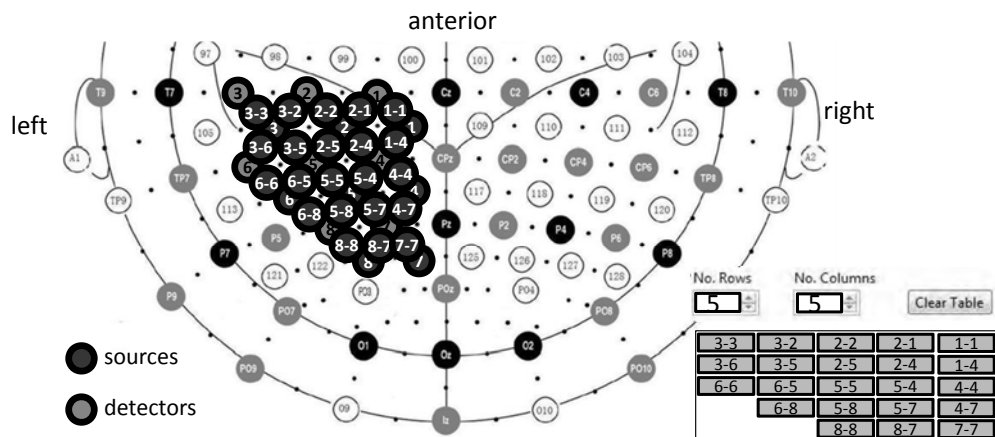
Block design diagram

- Baseline** Relax and sit on an armchair (30s)
 - Experiment I** Right-arm lifting (20 s)
 - Rest interval** Relax and sit on an armchair 20 s
 - Experiment II** Left-arm lifting (20 s)
- (Overall ~7.2 mins)

※Experiment States were marked by "F1" and Rest intervals were marked by "F3"

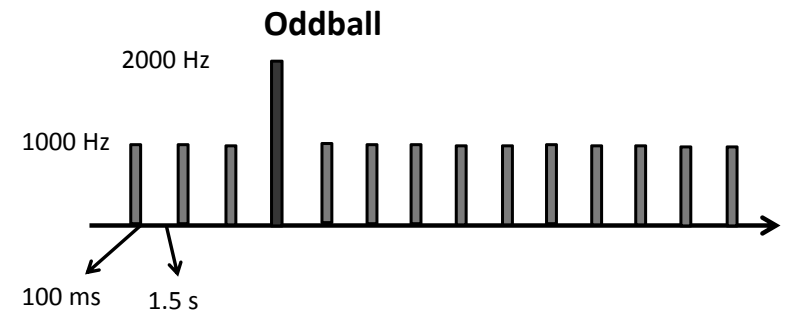


Oddball task



Event-Related design

- 12 oddball events (8% of total number)
- 3~6 regular tones before, and 10 after oddball



THE END

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