

# User manual

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## **Table of contents**

CHAPTER	1: Installation and configuration	12
Introduc	tion	12
Forewor	ds	13
general	remarks	14
1. Real	l time experiment	
2. Pictu 3. Tabl	et coordinate representation	
I. har	-dware	17
I.1.	Requirements	
I.2. I 3	Tablet installation	18 19
I.4.	Eye & Pen installation	
I.5.	Starting Eye and Pen	20
II. Dev	vices configuration	22
II.1. II.2.	Eye tracker configuration	
II.2.1	1. Eye tracker model	
11.2.2	a) Eyelink I, II and 1000 (S.R. Research)	27
	<ul> <li>b) ASL -504 (Applied Science Laboratory)</li> <li>c) iViewX (S.M.I. GmbH)</li> </ul>	28 29
11.2.2	d) Tablet (pen tracking)	31 22
11.2.3	a) Calibration on screen	
II.3.	b) Calibration on non-LCD tablet Audio recording device	
II.4.	In / Out device	
III. Dev	vice tests	38
III.1.	Tablet tests	
III.1. III.1.	.2. Tablet performance test	
III.2.	Eye tracker tests	39 30
III.2. III.2.	.2. Eye tracker performance test	
III.3.	Audio tests	40 41
III.4. III.5.	I/O tests	
IV. Dis	play configuration parameters	42
V. Acc	quisition configuration parameters	45
V.1.	Simple acquisition	
v.2. V.3.	NetSync: network-managed "Script" acquisition	
VI. Dat	ta analysis configuration parameters	51
VI.1.	New analysis configuration	
V1.2.	Analysis conniguration	54

VII. Visu	Protocol configuration	57
	Jalisations configuration	58
VIII. Cor	Ifiguring tools	60
IX. App	lication parameter configuration	62
X. Sav	e / load configuration parameters	64
CHAPTER	2: data acquisition	66
I. Intr I.1. I.2.	oduction Acquisition modes Session logging	66 66 67
I.3. I.4.	About timing Acquisition environment	67 67
II. "Sir	nple" acquisition	68
III. Scr	ipt-based acquisition	69
III.1.	Script-based acquisition dialog box	69
Grou	Add a group to the list	70 70
	Remove a group from the list	71
III.2. III.3.	Script editor Script commands	71
IV. Net	sync	73
IV.1.	Presentation	73
IV.2. IV.3.	Master	75
V. retr	ospective comments	70
Templa	te	81
Templa CHAPTER	te 3: data analysis	81 81
Templa CHAPTER I. Intr	te <b>3: data analysis</b> oduction	81 83 83
Templa CHAPTER I. Intr II. Sta	te <b>3: data analysis</b> oduction rt an analysis	81 83 83 84
Templa CHAPTER I. Intr II. Sta III. Rec	te <b>3: data analysis</b> roduction rt an analysis cording session (log)	81 83 83 84 84
Templa <b>CHAPTER</b> I. Intr II. Sta III. Rec IV. Info	te <b>3: data analysis</b> roduction rt an analysis cording session (log) prmation available at any time	81 83 83 84 84 84
Templa <b>CHAPTER</b> I. Intr II. Sta III. Rec IV. Info IV.1. IV.2.	te <b>3: data analysis</b> roduction rt an analysis cording session (log) prmation available at any time A tool for coding Information bar (status bar)	81 83 83 84 84 84 87 88 89
Templa <b>CHAPTER</b> I. Intr II. Sta III. Rec IV. Info IV.1. IV.2. IV.3.	te <b>3: data analysis</b> roduction rt an analysis cording session (log) prmation available at any time A tool for coding Information bar (status bar) History.	81 83 84 84 84 84 87 88 89 90
Templa <b>CHAPTER</b> I. Intr II. Sta III. Rec IV. Info IV.1. IV.2. IV.3. V. Nav V.1.	te 3: data analysis roduction rt an analysis cording session (log) prmation available at any time A tool for coding Information bar (status bar) History igation Introduction	81 83 83 84 84 87 88 89 90 91
Templa <b>CHAPTER</b> I. Intr II. Sta III. Rec IV. Info IV.1. IV.2. IV.3. V. Nav V.1. V.2.	te 3: data analysis roduction rt an analysis cording session (log) prmation available at any time A tool for coding Information bar (status bar) History //igation Introduction Navigating from one event to another	81 83 83 84 84 87 88 89 90 91 91 92
Templa <b>CHAPTER</b> I. Intr II. Sta III. Rec IV. Info IV.1. IV.2. IV.3. V. Nav V.1. V.2. V.3. V.4	te 3: data analysis roduction rt an analysis cording session (log) prmation available at any time A tool for coding Information bar (status bar) History rigation Introduction Navigating from one event to another Navigating from one pause to another Navigating from one pause to another	81 83 84 84 84 87 87 90 91 91 91 92 93
Templa <b>CHAPTER</b> I. Intr II. Sta III. Rec IV. Info IV.1. IV.2. IV.3. V. Nav V.1. V.2. V.3. V.4. V.5.	te 3: data analysis roduction rt an analysis cording session (log) prmation available at any time A tool for coding Information bar (status bar) History rigation Introduction Navigating from one event to another Navigating from one fixation to another Navigating through "Eve" data filtered by code	81 83 83 84 84 87 87 89 90 91 91 91 91 92 93 94 95
Templa <b>CHAPTER</b> I. Intr II. Sta III. Rec IV. Info IV.1. IV.2. IV.3. V. Nav V.1. V.2. V.3. V.4. V.5. V.6.	te 3: data analysis coduction rt an analysis cording session (log) cording session (log) cormation available at any time A tool for coding Information bar (status bar) History /igation Introduction Navigating from one event to another Navigating from one pause to another Navigating from one fixation to another Navigating from one fixation to another Navigating through "Eye" data filtered by code Navigating through "Tab" data filtered by code	91 81 83 84 84 84 87 88 90 91 91 91 91 91 92 93 94 95 96
Templa <b>CHAPTER</b> I. Intr II. Sta III. Rec IV. Info IV.1. IV.2. IV.3. V. Nav V.1. V.2. V.3. V.4. V.5. V.6. V.7. V.2. V.2. V.2. V.3. V.4. V.5. V.6. V.7. V.2. V.7. V.2. V.7. V.2. V.3. V.4. V.5. V.6. V.7. V.2. V.7.	te 3: data analysis roduction rt an analysis cording session (log) bromation available at any time A tool for coding Information bar (status bar)	93 81 83 84 84 84 87 90 91 91 91 91 92 93 94 95 96 96

VI. Thre	esholds	98
VII. Alte	ring samples	99
VII.1.	Changing the sampling rate	99
VII.2.	Building eve fixations	100
VII.2.	1. Barvcenter method	101
VII.2.	2. Multi-threshold method	102
VII.2.	3. Speed threshold method	103
VII.3.	Filtering tablet data	104
VII.4	Building pauses	107
VII.4.	1 Build Up pauses	107
VII.4.	2 Build down pauses	108
	VII.4.2.1 Same coordinates	108
	VII.4.2.2 Barycenter method	108
	VII.4.2.3 Speed	110
VIII. Visu	alisations	111
VIII.1.	Introduction	111
VIII 2	Visualisations configuration	111
VIII 3	Visualisation as "Circles"	111
VIII 3		111
VIII.3	2 Fixations	112
VIII.3	3. AQI scanpath	
VIII.4.	Visualisations as "Colors"	113
VIII.4	1. Pauses	113
VIII.4	.2. Pause duration classes	114
VIII.4	.3. Fixations	114
VIII.4	.4. Gaze to pen distance	115
VIII.5.	Data visualisation as "Graphs"	115
VIII.5	.1. Overlaid graphs	117
VIII.5	.2. Side-by-side graphs	117
IX. Shif	t lavers	118
X. Data	a coding	121
X.1.	Manually-coded data	121
X.2.	Coding an item of tablet data when in trigger zone 1 or 2	121
X.3.	Assigning the -1 code to "Eye" data beyond the calibrated area.	122
X.4.	Coding "Eye" data in the Visual Zones (AOI)	122
X.5.	Erasing all the codes	125
X.6.	Replacing one code with another	125
X.7.	Word separation	126
X.7.1.	Step 1: overall tuning	127
X.7.2.	Step 2: word-by-word adjustment	128
	X.7.2.1 delete a word	130
	X.7.2.2 Inserting a word	
	X.7.2.3 What to do with separation data	132
XI. stati	istical Protocol description	134
XII Lleof	ful tools and functions	122
		120
∧11.1. VII ⊃	Audio coquencos	1 4 7
AII.Z.	AUDIO SEQUENCES	142
XII.3.	Successive data with the same code aggregation	143
X11.4.	Correct "out-of-field" erroneous Eye data	143
X11.5.		144
XII.6.	۲٥٥m	144

XII	[.7. (	Capture a picture of the analysis	146
XIII. XII XII	Save [I.1. ( [I.2. 9	analysis Creating a sub-analysis Saving an analysis	146 146 147
XIV. XIV	Data V.1. 9 XIV.1.1 XIV.1.2 XIV.1.3 XIV.1.4 XIV.1.5 XIV.1.6 V.2. 0	extraction Selection of information to extract Range Data Data Codes Tracing dynamics Visual zones (AOI) General Choose the type of events to extract	148 148 150 152 152 153 154 154
XV. XV XV XV XV	Data .1. I .2. I .3. I .4. I	exports Exporting sample data as a text file Exporting sample data as a Ductus file Exporting sample data as a Eye and Pen 2 file Exporting sample data as a Model file	157 157 158 159 159
CHAP.	TER 4	: other functions 1	L <b>61</b>
I. I.1 I.2	Keyb . I	oard: shortcuts, recorder and automation Menu accelerators and keyboard shortcuts Keyboard recorder	161 161 163
TT	Custo	mizing your workspace	164
II. II. II. II. II. II.	1.   2.   3. 9 4. ( 5.	Move toolbars. Make toolbars "float". Show / hide toolbars. Customize toolbars. Resize the "palette".	164 164 165 165 166
II. II. II. II. II. II.	1.   2.   3. 5 4. ( 5.	Move toolbars. Make toolbars "float". Show / hide toolbars. Customize toolbars. Resize the "palette".	164 164 165 165 166 167
II. II. II. II. II. IV. IV. IV. IV. IV.	1. 1 2. 1 3. 3 4. ( 5. 1 Modify Unit ( 1. An 2. Tal	Move toolbars. Make toolbars "float". Show / hide toolbars. Customize toolbars. Resize the "palette". display ratio	164 164 165 165 166 167 167 167 168 168
II. II. II. II. II. IV. IV. IV. IV. V.	1. 1 2. 1 3. 3 4. ( 5. 1 Modify Unit ( 1. An 2. Tal 3. Tal Syste	Move toolbars. Make toolbars "float". Show / hide toolbars. Customize toolbars. Resize the "palette". display ratio	164 164 165 165 166 167 167 167 167 168 168
II. II. II. II. II. IV. IV. IV. IV. V. V. VI.	1. 1 2. 1 3. 3 4. ( 5. 1 Modify Unit ( 1. An 2. Tal 3. Tal 3. Tal Syste	Move toolbars. Make toolbars "float". Show / hide toolbars. Customize toolbars. Resize the "palette". display ratio	164 164 165 165 166 167 167 167 167 168 168 169
II. II. II. II. II. IV. IV. IV. IV. V. V. VI. CHAP	1. 1 2. 1 3. 2 4. ( 5. 1 Modify Unit ( 1. An 2. Tal 3. Tal 3. Tal Syste Legal	Move toolbars. Make toolbars "float". Show / hide toolbars. Customize toolbars. Resize the "palette". r display ratio	164 164 165 165 166 167 167 167 167 168 168 169 169 169
II. II. II. II. II. III. N IV. IV. IV. IV. V. VI. CHAP I. I. I.1 I.2 I.3	1. 1 2. 1 3. 3 4. 0 5. 1 Modify Unit 0 1. An 2. Tal 3. Tal 3. Tal Syste Legal <b>TER 5</b>	Move toolbars. Make toolbars "float". Show / hide toolbars. Customize toolbars. Customize toolbars. Resize the "palette". r display ratio. conversions . gle - pixels blet units - distance blet units - pixels em information information and acknowledgements <b>custometry of the state of </b>	164 164 165 165 167 167 167 167 167 168 169 169 169 169 169 169 170 171 171 171
II. II. II. II. II. IV. IV. IV. IV. V. VI. CHAP I. I. I.1 I.2 I.3 II.	1. 1 2. 1 3. 3 4. 0 5. 1 Modify Unit 0 1. An 2. Tal 3. Tal Syste Legal <b>TER 5</b> NetSy	Move toolbars. Make toolbars "float". Show / hide toolbars. Customize toolbars. Resize the "palette". r display ratio. conversions. gle - pixels. blet units - distance. blet units - distance. blet units - pixels. em information. information and acknowledgements	164 164 165 165 167 167 167 167 167 168 169 169 169 169 169 169 170 171 171 171 171
II. II. II. II. II. II. IV. IV.	1. I 2. I 3. S 4. O 5. I Modify Unit o 1. An 2. Tal 3. Tal Syste Legal <b>TER 5</b> NetSy	Move toolbars.         Make toolbars "float".         Show / hide toolbars.         Customize toolbars.         Customize toolbars.         Resize the "palette".         r display ratio.         r display ratio.         conversions         gle - pixels.         blet units - distance.         blet units - pixels.         em information         information and acknowledgements         information and acknowledgements         wi-Fi router configuration.         Host configuration (clients and master).         Script.         guring the tablet with a double screen.	164 164 165 165 166 167 167 167 167 168 169 169 169 169 169 170 171 171 171 171 171
II. II. II. II. II. II. IV. IV.	1. I 2. I 3. S 4. O 5. I Modify Unit o 1. An 2. Tal 3. Tal 3. Tal Syste Legal <b>TER 5</b> NetSy	Move toolbars.         Make toolbars "float".         Show / hide toolbars.         Customize toolbars.         Resize the "palette".         r display ratio.         conversions         gle - pixels.         blet units - distance.         blet units - pixels.         em information         information and acknowledgements         stappendices         ync within a Wi-Fi network         Wi-Fi router configuration         Host configuration (clients and master)         Script.         guring the tablet with a double screen         isition session LOG file         us tree view	164 164 165 165 167 167 167 167 167 168 169 169 169 169 169 170 171 171 171 171 171 171 171

VI. VI. VI. VI.	<ul> <li>Frequently asked questions (FAQ)</li> <li>Calculate a picture's position on screen</li> <li>Where are ey and Pen configuration files ?</li> <li>Other matters</li> </ul>	
VII.	Data extraction column headers	176
VIII.	. Structure of "Eye and Pen" files	179
IX.	Registry keys (Windows)	
Х.	Troubleshooting	
XI.	Error messages	
XII.	Wintab32-compliant hardware manufacturers	
XIII. XII XII XII	. Parallel port wiring II.1. StimTracker II.2. Standard parallel cable II.3. Crosswired cable	
XIV.	Bibliography	186

## **Figure list**

Figure 1: Picture selection dialog box	.15
Figure 2: Selecting coordinates on the tablet.	.16
Figure 3: A tablet connected to a laptop	.18
Figure 4: The Eye and Pen PC "drives" the tablet and receives the eye-tracking data	19
Figure 5: Selecting the application language.	.20
Figure 6: Launching the acquisition configuration panel.	.22
Figure 7: configuration panel, "Tablet" tab.	.23
Figure 8: Acquisition configuration panel, "Eye tracker" tab.	.25
Figure 9: Evelink parameter configuration.	.27
Figure 10: ASL-504 parameter configuration.	.28
Figure 11: iViewX parameter configuration.	.29
Figure 12: Setting up two planes.	.31
Figure 13: Acquisition configuration panel, "Eye tracker" tab.	.32
Figure 14: A tablet and a PC screen recording device.	.33
Figure 15: Calibration limit	.34
Figure 16: Audio recording configuration.	.35
Figure 17 <sup>-</sup> parallel port configuration	36
Figure 18 <sup>-</sup> retrieving parallel port adress in Windows	37
Figure 19 <sup>-</sup> retrieving another parallel port adress in Windows	37
Figure 20 <sup>.</sup> Visual tablet test	38
Figure 21: a Tablet PC performance test	39
Figure 22: Visual eve tracker test	39
Figure 23: Audio recording settings	40
Figure 24: audio input Level meter	40
Figure 25: sending a message over the network between 2 computers	41
Figure 26: sending a value through the narallel port	41
Figure 27: Acquisition configuration panel "Display" tab	42
Figure 28: A file used to unmask the display	42
Figure 20: Manning tablet to screen	11
Figure 30: Display width and beight adjusted	11
Figure 31: Configuration panel "Simple" tab	15
Figure 32: Configuration panel "Script" tab	47
Figure 33: Configuration panel "Network" tab	10
Figure 31: Configuration panel, "New analysis" tab	51
Figure 35: Configuration panel, "Analysis" tab	5/
Figure 36: Develoal congration between screen and tablet dialog box	56
Figure 37: Configuration papel "Display" tab	57
Figure 37. Configuration panel, Display tab	57
Figure 30: Coloulation of fovoal vision diamotor on scroon	50
Figure 40: Tools parameters	60
Figure 41: Application parameter settings	62
Figure 41. Application parameters	61
Figure 42. Saving the configuration parameters.	65
Figure 43. Loading the configuration parameters	60
Figure 44. Simple acquisition dialog box	00.
Figure 40. Script-based acquisition dialog box	09
Figure 40. Scrolling down the group selection list.	.70
Figure 47. Add a group name to the group list.	./U 74
Figure 46: A new group name in the group list.	./
Figure 49: Removing a group name from the group list.	71
Figure 50: Script ealtor menus	.72
	.74
Figure 52: NetSync Interface.	.75

Figure 54: NetSync toolbars	76
Figure 55: Selecting a script for all the clients.	
Figure 56: Toolbar for recording retrospective comments	79
Figure 57: Describing a retrospective comment	80
Figure 58: Modifying a comment's label	.80
Figure 59: Template (hierarchically organized).	
Figure 60: Template edition functions.	
Figure 61. Modifying a template item	82
Figure 62' Acquisition session	84
Figure 63: Session log showing recordings only	85
Figure 64: A "RecStandard" recording session log	86
Figure 65: Data analysis screen	87
Figure 66: Menu to display tools	88
Figure 67: Representation of a pause	88
Figure 68: The coding tool	88
Figure 69: the information bar	89
Figure 70: History dialog box listing actions	90
Figure 71: "Spatial" navigation	91
Figure 72: Navigating from one event to another	92
Figure 73: Set the protocol replay speed	92
Figure 74: animate nauses when replaying a protocol	93
Figure 75: Stop protocol replay	93
Figure 76: Navigating through nauses	Q3
Figure 77: Choose navigation criterion (duration or number of nauses)	Q1
Figure 78: Navigating through fixations	
Figure 79: Choose navigation criterion(duration or fixation number)	95
Figure 80: Navigating with Eve data codes	95
Figure 81: Navigating with tablet data codes	90
Figure 82: Navigating according to the distance between gaze and pen positions	90
Figure 82: Navigating according to the distance between gaze and pen positions	96
Figure 82: Navigating with tablet data codes. Figure 82: Navigating according to the distance between gaze and pen positions. Figure 83: The clock.	96 97
Figure 82: Navigating with tablet data codes. Figure 82: Navigating according to the distance between gaze and pen positions. Figure 83: The clock. Figure 84: Dialog box for selecting a particular "time" in the protocol.	96 97 97
Figure 82: Navigating with tablet data codes. Figure 82: Navigating according to the distance between gaze and pen positions. Figure 83: The clock. Figure 84: Dialog box for selecting a particular "time" in the protocol. Figure 85: Audio is synchronized with Tab samples.	96 97 97 97
Figure 82: Navigating with tablet data codes. Figure 82: Navigating according to the distance between gaze and pen positions. Figure 83: The clock. Figure 84: Dialog box for selecting a particular "time" in the protocol. Figure 85: Audio is synchronized with Tab samples. Figure 86: Audio toolbar display. Figure 87: Throshold dialog box	96 97 97 97 97
Figure 82: Navigating with tablet data codes. Figure 82: Navigating according to the distance between gaze and pen positions. Figure 83: The clock. Figure 84: Dialog box for selecting a particular "time" in the protocol. Figure 85: Audio is synchronized with Tab samples. Figure 86: Audio toolbar display. Figure 87: Threshold dialog box. Figure 88: Recompling dialog box.	96 97 97 97 97 97 98
Figure 82: Navigating according to the distance between gaze and pen positions. Figure 83: The clock. Figure 84: Dialog box for selecting a particular "time" in the protocol. Figure 85: Audio is synchronized with Tab samples. Figure 86: Audio toolbar display. Figure 87: Threshold dialog box. Figure 88: Resampling dialog box.	90 96 97 97 97 97 97 98 99
Figure 82: Navigating with tablet data codes. Figure 82: Navigating according to the distance between gaze and pen positions. Figure 83: The clock. Figure 84: Dialog box for selecting a particular "time" in the protocol. Figure 85: Audio is synchronized with Tab samples. Figure 86: Audio toolbar display. Figure 87: Threshold dialog box. Figure 88: Resampling dialog box. Figure 89: End of resampling processing dialog box.	96 97 97 97 97 97 98 99 100
Figure 82: Navigating with tablet data codes. Figure 82: Navigating according to the distance between gaze and pen positions. Figure 83: The clock. Figure 84: Dialog box for selecting a particular "time" in the protocol. Figure 85: Audio is synchronized with Tab samples. Figure 86: Audio toolbar display. Figure 87: Threshold dialog box. Figure 88: Resampling dialog box. Figure 89: End of resampling processing dialog box. Figure 90: Steps for building a fixation. Figure 91: Puilding fixation.	96 97 97 97 97 97 98 99 100 101
Figure 82: Navigating with tablet data codes. Figure 82: Navigating according to the distance between gaze and pen positions. Figure 83: The clock. Figure 84: Dialog box for selecting a particular "time" in the protocol. Figure 85: Audio is synchronized with Tab samples. Figure 86: Audio toolbar display. Figure 87: Threshold dialog box. Figure 88: Resampling dialog box. Figure 89: End of resampling processing dialog box. Figure 90: Steps for building a fixation. Figure 91: Building fixations using the "barycentric" method.	96 97 97 97 97 97 97 98 99 100 101 102
Figure 82: Navigating according to the distance between gaze and pen positions. Figure 83: The clock. Figure 84: Dialog box for selecting a particular "time" in the protocol. Figure 85: Audio is synchronized with Tab samples. Figure 86: Audio toolbar display. Figure 87: Threshold dialog box. Figure 88: Resampling dialog box. Figure 89: End of resampling processing dialog box. Figure 90: Steps for building a fixation. Figure 91: Building fixations using the "barycentric" method. Figure 92: Building fixations using the "multi-threshold" method.	96 97 97 97 97 97 98 99 100 101 102 103
Figure 82: Navigating with tablet data codes. Figure 82: Navigating according to the distance between gaze and pen positions. Figure 83: The clock. Figure 84: Dialog box for selecting a particular "time" in the protocol. Figure 85: Audio is synchronized with Tab samples. Figure 86: Audio toolbar display. Figure 87: Threshold dialog box. Figure 88: Resampling dialog box. Figure 89: End of resampling processing dialog box. Figure 90: Steps for building a fixation. Figure 91: Building fixations using the "barycentric" method. Figure 92: Building fixations using the "multi-threshold" method. Figure 93: Building fixations using the "Speed" method.	96 97 97 97 97 98 99 100 101 102 103 103
Figure 82: Navigating according to the distance between gaze and pen positions. Figure 83: The clock. Figure 84: Dialog box for selecting a particular "time" in the protocol. Figure 85: Audio is synchronized with Tab samples. Figure 86: Audio toolbar display. Figure 87: Threshold dialog box. Figure 88: Resampling dialog box. Figure 89: End of resampling processing dialog box. Figure 90: Steps for building a fixation. Figure 91: Building fixations using the "barycentric" method. Figure 92: Building fixations using the "multi-threshold" method. Figure 93: Building fixations using the "Speed" method. Figure 94: setting parameters of the Butterworth filter.	96 97 97 97 97 98 99 100 101 102 103 103 104
Figure 82: Navigating with tablet data codes. Figure 82: Navigating according to the distance between gaze and pen positions. Figure 83: The clock. Figure 84: Dialog box for selecting a particular "time" in the protocol. Figure 85: Audio is synchronized with Tab samples. Figure 86: Audio toolbar display. Figure 87: Threshold dialog box. Figure 88: Resampling dialog box. Figure 89: End of resampling processing dialog box. Figure 90: Steps for building a fixation. Figure 91: Building fixations using the "barycentric" method. Figure 92: Building fixations using the "multi-threshold" method. Figure 93: Building fixations using the "Speed" method. Figure 94: setting parameters of the Butterworth filter. Figure 95: Butterworth filter settings.	96 97 97 97 97 97 97 98 99 100 101 102 103 103 104 105
Figure 82: Navigating with tablet data codes. Figure 82: Navigating according to the distance between gaze and pen positions. Figure 83: The clock. Figure 84: Dialog box for selecting a particular "time" in the protocol. Figure 85: Audio is synchronized with Tab samples. Figure 86: Audio toolbar display. Figure 87: Threshold dialog box. Figure 88: Resampling dialog box. Figure 89: End of resampling processing dialog box. Figure 90: Steps for building a fixation. Figure 91: Building fixations using the "barycentric" method. Figure 92: Building fixations using the "multi-threshold" method. Figure 93: Building fixations using the "Speed" method. Figure 94: setting parameters of the Butterworth filter. Figure 95: Butterworth filter settings. Figure 96: Frequency spectrum.	96 97 97 97 97 97 98 99 100 101 102 103 103 104 105 106
Figure 82: Navigating according to the distance between gaze and pen positions. Figure 83: The clock. Figure 84: Dialog box for selecting a particular "time" in the protocol. Figure 85: Audio is synchronized with Tab samples. Figure 86: Audio toolbar display. Figure 87: Threshold dialog box. Figure 88: Resampling dialog box. Figure 89: End of resampling processing dialog box. Figure 90: Steps for building a fixation. Figure 91: Building fixations using the "barycentric" method. Figure 92: Building fixations using the "multi-threshold" method. Figure 93: Building fixations using the "Speed" method. Figure 94: setting parameters of the Butterworth filter. Figure 95: Butterworth filter settings. Figure 96: Frequency spectrum. Figure 97a: 4th order, 15 Hz cut off. Figure 97b: 4th order filter, 10 Hz cut off. Figure 97a: 4th order, 15 Hz cut off.	96 97 97 97 97 97 98 99 100 101 102 103 103 104 105 106 106
Figure 82: Navigating with tablet data codes. Figure 82: Navigating according to the distance between gaze and pen positions. Figure 83: The clock. Figure 84: Dialog box for selecting a particular "time" in the protocol. Figure 85: Audio is synchronized with Tab samples. Figure 86: Audio toolbar display. Figure 87: Threshold dialog box. Figure 88: Resampling dialog box. Figure 89: End of resampling processing dialog box. Figure 90: Steps for building a fixation. Figure 91: Building fixations using the "barycentric" method. Figure 92: Building fixations using the "multi-threshold" method. Figure 93: Building fixations using the "Speed" method. Figure 94: setting parameters of the Butterworth filter. Figure 95: Butterworth filter settings. Figure 96: Frequency spectrum. Figure 97a: 4th order, 15 Hz cut off. Figure 97b: 4th order filter, 10 Hz cut off. Figure 97c: 6th order, 10 Hz cut off (artefacts appears).	96 97 97 97 97 98 99 100 101 102 103 103 104 105 106 106 107
Figure 81: Navigating according to the distance between gaze and pen positions. Figure 82: Navigating according to the distance between gaze and pen positions. Figure 83: The clock. Figure 84: Dialog box for selecting a particular "time" in the protocol. Figure 85: Audio toolbar display. Figure 86: Audio toolbar display. Figure 87: Threshold dialog box. Figure 88: Resampling dialog box. Figure 89: End of resampling processing dialog box. Figure 90: Steps for building a fixation. Figure 91: Building fixations using the "barycentric" method. Figure 92: Building fixations using the "multi-threshold" method. Figure 93: Building fixations using the "Speed" method. Figure 94: setting parameters of the Butterworth filter. Figure 95: Butterworth filter settings. Figure 96: Frequency spectrum. Figure 97a: 4th order, 15 Hz cut off. Figure 97b: 4th order filter, 10 Hz cut off. Figure 98: Selecting which pause sort to build. Figure 90: Building away and a sort of build.	96 97 97 97 97 97 97 98 99 100 101 102 103 103 104 105 106 106 107 107
Figure 81: Navigating with tablet data codes. Figure 82: Navigating according to the distance between gaze and pen positions. Figure 83: The clock. Figure 84: Dialog box for selecting a particular "time" in the protocol. Figure 85: Audio is synchronized with Tab samples. Figure 86: Audio toolbar display. Figure 87: Threshold dialog box. Figure 89: End of resampling processing dialog box. Figure 90: Steps for building a fixation. Figure 91: Building fixations using the "barycentric" method. Figure 92: Building fixations using the "multi-threshold" method. Figure 93: Building fixations using the "Speed" method. Figure 94: setting parameters of the Butterworth filter. Figure 95: Butterworth filter settings. Figure 96: Frequency spectrum. Figure 97a: 4th order, 15 Hz cut off. Figure 97b: 4th order filter, 10 Hz cut off. Figure 97c: 6th order, 10 Hz cut off (artefacts appears). Figure 99: Building pauses, same coordinates method.	96 97 97 97 97 97 97 97 98 99 100 101 102 103 103 104 105 106 106 107 107
Figure 82: Navigating with abiet data codes	96 97 97 97 97 97 97 98 99 100 101 102 103 104 105 106 106 107 107 108 109
Figure 81: Navigating with tablet data codes. Figure 82: Navigating according to the distance between gaze and pen positions. Figure 83: The clock. Figure 84: Dialog box for selecting a particular "time" in the protocol. Figure 85: Audio toolbar display. Figure 86: Audio toolbar display. Figure 87: Threshold dialog box. Figure 89: End of resampling processing dialog box. Figure 90: Steps for building a fixation. Figure 91: Building fixations using the "barycentric" method. Figure 92: Building fixations using the "barycentric" method. Figure 93: Building fixations using the "barycentric" method. Figure 93: Building fixations using the "Speed" method. Figure 94: setting parameters of the Butterworth filter. Figure 95: Butterworth filter settings. Figure 97a: 4th order, 15 Hz cut off. Figure 97b: 4th order filter, 10 Hz cut off. Figure 97c: 6th order, 10 Hz cut off (artefacts appears). Figure 98: Selecting which pause sort to build. Figure 99: Building pauses, same coordinates method. Figure 100: Building down pauses, barycenter method. Figure 101: Building down pauses, speed method.	96 97 97 97 97 97 98 99 100 101 102 103 104 105 106 106 107 107 107 108 109 110
Figure 82: Navigating according to the distance between gaze and pen positions. Figure 83: The clock. Figure 84: Dialog box for selecting a particular "time" in the protocol. Figure 85: Audio is synchronized with Tab samples. Figure 86: Audio toolbar display. Figure 87: Threshold dialog box. Figure 88: Resampling dialog box. Figure 89: End of resampling processing dialog box. Figure 90: Steps for building a fixation. Figure 91: Building fixations using the "barycentric" method. Figure 92: Building fixations using the "barycentric" method. Figure 93: Building fixations using the "barycentric" method. Figure 94: setting parameters of the Butterworth filter. Figure 95: Butterworth filter settings. Figure 96: Frequency spectrum. Figure 97a: 4th order, 15 Hz cut off. Figure 97b: 4th order filter, 10 Hz cut off. Figure 98: Selecting which pause sort to build. Figure 99: Building pauses, same coordinates method. Figure 100: Building down pauses, barycenter method. Figure 102: Dialding down pauses, speed method. Figure 102: Visuelisation with empty circles. Figure 102: Visuelisation with empty circles.	96 97 97 97 97 97 97 97 97 97 100 101 102 103 103 104 105 106 107 107 107 108 109 110
Figure 82: Navigating according to the distance between gaze and pen positions. Figure 83: The clock. Figure 84: Dialog box for selecting a particular "time" in the protocol. Figure 85: Audio is synchronized with Tab samples. Figure 86: Audio toolbar display. Figure 87: Threshold dialog box. Figure 88: Resampling dialog box. Figure 89: End of resampling processing dialog box. Figure 90: Steps for building a fixation. Figure 91: Building fixations using the "barycentric" method. Figure 92: Building fixations using the "barycentric" method. Figure 93: Building fixations using the "Speed" method. Figure 94: setting parameters of the Butterworth filter. Figure 95: Butterworth filter settings. Figure 96: Frequency spectrum. Figure 97a: 4th order, 15 Hz cut off. Figure 97b: 4th order filter, 10 Hz cut off. Figure 97c: 6th order, 10 Hz cut off (artefacts appears). Figure 98: Selecting which pause sort to build. Figure 99: Building down pauses, barycenter method. Figure 100: Building down pauses, speed method. Figure 101: Building down pauses, speed method. Figure 102: Pauses visualisation with empty circles. Figure 103: Visualisation of fixations.	96 97 97 97 97 97 97 97 97 97 100 101 102 103 103 104 105 106 106 107 107 108 109 110 111 112
Figure 82: Navigating according to the distance between gaze and pen positions. Figure 82: Navigating according to the distance between gaze and pen positions. Figure 83: The clock. Figure 84: Dialog box for selecting a particular "time" in the protocol. Figure 85: Audio is synchronized with Tab samples. Figure 86: Audio toolbar display. Figure 87: Threshold dialog box. Figure 88: Resampling dialog box. Figure 89: End of resampling processing dialog box. Figure 90: Steps for building a fixation. Figure 91: Building fixations using the "barycentric" method. Figure 92: Building fixations using the "barycentric" method. Figure 93: Building fixations using the "Speed" method. Figure 94: setting parameters of the Butterworth filter. Figure 95: Butterworth filter settings. Figure 96: Frequency spectrum. Figure 97c: 6th order, 15 Hz cut off. Figure 97b: 4th order filter, 10 Hz cut off. Figure 97c: 6th order, 10 Hz cut off (artefacts appears). Figure 98: Selecting which pause sort to build. Figure 99: Building pauses, same coordinates method. Figure 100: Building down pauses, barycenter method. Figure 101: Building down pauses, speed method. Figure 102: Pauses visualisation with empty circles. Figure 103: Visualisation of fixations. Figure 104: Visualisation of fixations. Figure 104: Visualisation of fixations and eye movements.	96 97 97 97 97 97 97 97 97 100 101 102 103 103 104 105 106 106 107 107 108 109 110 111 112 112
Figure 82: Navigating according to the distance between gaze and pen positions. Figure 83: The clock. Figure 84: Dialog box for selecting a particular "time" in the protocol. Figure 85: Audio is synchronized with Tab samples. Figure 86: Audio toolbar display. Figure 87: Threshold dialog box. Figure 88: Resampling dialog box. Figure 89: End of resampling processing dialog box. Figure 90: Steps for building a fixation. Figure 91: Building fixations using the "barycentric" method. Figure 92: Building fixations using the "barycentric" method. Figure 93: Building fixations using the "barycentric" method. Figure 94: setting parameters of the Butterworth filter. Figure 95: Butterworth filter settings. Figure 96: Frequency spectrum. Figure 97: 6th order, 15 Hz cut off. Figure 97b: 4th order filter, 10 Hz cut off. Figure 97c: 6th order, 10 Hz cut off (artefacts appears). Figure 98: Selecting which pause sort to build. Figure 99: Building down pauses, same coordinates method. Figure 100: Building down pauses, speed method. Figure 101: Building down pauses, speed method. Figure 102: Pauses visualisation with empty circles. Figure 103: Visualisation of fixations. Figure 104: Visualisation of fixations. Figure 105: Visualisation of AOI scanpath. Figure 105: Visualisation of AOI scanpath.	96 97 97 97 97 97 97 97 97 100 101 102 103 104 105 106 107 107 108 109 110 111 112 112
Figure 82: Navigating according to the distance between gaze and pen positions. Figure 83: The clock. Figure 84: Dialog box for selecting a particular "time" in the protocol. Figure 85: Audio is synchronized with Tab samples. Figure 86: Audio toolbar display. Figure 87: Threshold dialog box. Figure 89: End of resampling processing dialog box. Figure 90: Steps for building a fixation. Figure 91: Building fixations using the "barycentric" method. Figure 92: Building fixations using the "barycentric" method. Figure 93: Building fixations using the "Speed" method. Figure 94: setting parameters of the Butterworth filter. Figure 95: Butterworth filter settings. Figure 96: Frequency spectrum. Figure 97a: 4th order, 15 Hz cut off. Figure 97b: 4th order filter, 10 Hz cut off. Figure 99: Building pauses, same coordinates method. Figure 99: Building down pauses, barycenter method. Figure 100: Building down pauses, barycenter method. Figure 101: Building down pauses, speed method. Figure 102: Pauses visualisation with empty circles. Figure 103: Visualisation of fixations. Figure 104: Visualisation of fixations. Figure 105: Visualisation of fixations and eye movements. Figure 106: Pause preview as colors.	96 97 97 97 97 97 98 99 100 101 102 103 103 104 105 106 107 106 107 107 108 109 110 111 112 112 113 113

Figure 108: Fixation preview in "temperature" mode	114
Figure 109: Gaze to pen distance visualisation	115
Figure 110: Graphs display options.	115
Figure 111: Data visualisation as overlaid series.	117
Figure 112: Data visualisation as side-by-side series.	117
Figure 113: Dialog box for adjusting the position of the layers.	119
Figure 114: Setting a layer shift using right mouse button selection	120
Figure 113: Selecting the laver you want to move using a contextual menu	120
Figure 114: Shifting values are updated in the dialog box	120
Figure 115. Automatic coding of data in trigger zones	121
Figure 116. AOI definition/selection nanel	122
Figure 117: AOI selection nanel	124
Figure 118: Foveal vision at the edge of a visual zone (AOI)	124
Figure 110: Selecting the type of data for resetting the codes	125
Figure 120: Replacing the codes given to the data types	125
Figure 120. Replacing the codes given to the data types	125
Figure 121. Word separation menu items.	120
Figure 122. Word separation, step 1	120
Figure 125. Word Separation, Step 2	120
Figure 124a: A word deletion.	100
Figure 124b: Deletion of a "word" (new current word).	130
Figure 125a: Inserting a "word" (resizing).	131
Figure 125b: Inserting a "word" (size of word reduced).	131
Figure 125c: Inserting a "word" (new word is added).	132
Figure 126 : selecting operations to perform on word separation	132
Figure 127: Statistical description.	134
Figure 128: Graph showing pause and fixation distribution (logarithmic scale)	136
Figure 129: Pen movement speed distribution	136
Figure 130: Gaze movement speed distribution	137
Figure 131: Protocol recording device specifications.	137
Figure 132: The tool for defining sequences.	138
Figure 133: Describing a sequence.	138
Figure 134: Editing a sequence label	139
Figure 135: Sequence management menu.	140
Figure 136: Editing the entire sequence list	141
Figure 137: A protocol with audio recording	
Figure 138. Audio sequence toolbar and audio waveform display	142
Figure 139: Audio sequences management menu	142
Figure 140: Select code for aggregation	143
Figure 141: Set the tolerance margin width	143
Figure 142: Increasing display	140
Figure 1/3: "700m" tool	1/5
Figure 143. Zoom "at work"	1/5
Figure 144. 200111 di WOIK	145
Figure 146. Defining auch analysis time limite	140
Figure 140: Defining sub-analysis time limits	140
Figure 147: Saving an analysis under a new name	147
Figure 148: Extraction preference menu.	148
Figure 149: Select the range of data to extract.	148
Figure 150: Select the data to output.	150
Figure 151: Define codes to set filter for extraction.	152
Figure 152: Tracing dynamics extraction preferences	152
Figure 153: "Eye" data in visual zone extraction preferences	153
Figure 154: Overall data extraction preferences.	154
Figure 155: Data extraction menu	154
Figure 156: Naming the output file	157
Figure 157: Naming the text file.	157
Figure 158: Naming the Ductus file	158

Figure	159: Naming the Eye and Pen 2 file	159
Figure	160: Naming the Model file.	160
Figure	161: Setting/unsetting shortcuts for menus	162
Figure	162: Keyboard keypress recorder.	163
Figure	163: The recorder is switched on	163
Figure	164: Saving keypresses in a text file	163
Figure	165: Dragging a toolbar.	164
Figure	166: Toolbar moved	164
Figure	167: Undocking a toolbar	164
Figure	168: A floating toolbar	164
Figure	169: Docking a toolbar	165
Figure	170: Toolbar customization panel.	165
Figure	171: Shrinking the tool.	166
Figure	172: Resizing the code list	166
Figure	173: Hiding the code list.	167
Figure	174: Angle (degrees) to pixels conversion.	167
Figure	175: Tool to convert Tab units to distance units.	168
Figure	176: Tablet units to pixels conversion.	168
Figure	177: System information dialog box.	169
Figure	178: Information and acknowledgements dialog box	169
Figure	179: NetSync within a Wi-Fi network.	170
Figure	180: Eye and Pen configuration folder.	176
Figure	181: parallel port (DB25) to StimTracker (RJ45) wiring	185
Figure	182: Crosswired parallel cable (DB25)	185
Figure Figure	181: parallel port (DB25) to StimTracker (RJ45) wiring 182: Crosswired parallel cable (DB25)	18 18

#### INTRODUCTION

Writing is a complex human activity. The writer has to compose a coherent message and formulate it in accordance with linguistic rules (grammar, spelling), all the while taking the characteristics of the potential reader into account. The ability to manage all these various mental activities, as well as their time course, can be regarded as an indicator of the writer's expertise (Alamargot & Chanquoy, 2001). For cognitive science researchers, identifying the rules that govern the engagement and course of these mental processes is an essential step towards a greater understanding of writing and processing (Levy & Ransdell, 1996). The Eye and Pen software was designed to help researchers attain this goal (Chesnet & Alamargot, 2005; Alamargot, Chesnet, Dansac & Ros, 2007).

Eye and Pen can be mainly (but not exclusively) used in the context of handwriting studies, whatever the graphic format (from text to drawing).

The 'Eye and Pen' software was designed to allow the synchronous recording of handwriting (by means of a digitizing tablet: coordinates and state of the pen) and eye movements (via an optical eye-tracking system: eye coordinates in the task environment). The conjunction of these two signals allows us to study the synchronization between eye and pen movements during pausing and writing periods. For instance, it makes it possible to study not only the visual control of graphomotor execution, but also the reading of the text in order to revise it and the consultation of documentary sources with a view to summarizing them. Eye and Pen allows users to conduct these investigations in a continuous way, without interrupting the activity underway or increasing cognitive load.

In short, this software makes it possible to establish a link between the visual input of writing (gazes on documentary sources and/or text produced so far) and its graphomotor output (pausing and writing phases, drawing). This link can be studied in various situations and media (paper, computer screen, screen tablet, etc.)

The Eye and Pen software can be regarded as a type of digital video recorder, which allows users to watch and play-replay the process of graphic generation and associated eye movements as often as they wish. A semi-automated coding system enables users to characterize and classify ocular and graphomotor events.

Eye and Pen has two different modes of operation:

- 1. the acquisition mode, allowing the recording of tablet and eye tracker data;
- 2. the analysis mode, allowing the selection (with various filters) and editing (in text format) of data.

Obviously, using an eyetracking device is not mandatory, and you can choose solely to record and analyze written production (and/or drawing).

Note: on our Website <u>http://www.eyeandpen.net</u> you will find all the latest information, updates and much, much more besides.

#### FOREWORDS

As in any new version, the software has undergone a number of changes. Main changes are summarized here.

#### **Documentation**

Eye and Pen manual is now splitted in two volumes, this user manual, and a volume dedicated to scripting.

#### **Discontinued support**

A number of devices and file formats support have been removed, because they are not used anymore:

- 1. EyePuter eyetracker (its manufacturer Electronica, S.A discontinued the device more than 10 years ago)
- 2. Magneto file format (MS-Dos software)
- 3. G-Studio file format (MS-Dos software)

Although SMI has recently been acquired by Apple, and therefore stopped eyetrackers production, we'll still support their devices in the coming years.

#### <u>New file format</u>

Eye and Pen 3 uses a new data file format for Tab and Eye data which can cope with negative and greater values than the basic tablet range. These files are not backward compatible per se (can not be directly opened with EP2). We added a menu item to export these files into EP2 data file format, provided that coordinates and pressure range matches with Eye and Pen 2 capabilites.

#### New tablet data

We added the recording of pen mouvements when it is "in the air", as it may be a valuable source of information.

Yet, a limitation is the capability of the device to keep track of the pen: current tablets (digitizers) have no notion of height above the surface and can not keep track of the pen to more than about a rough half a centimeter high.

If you are interested in "In the air" mouvements, we recommend following this method:

- 1. Extract "In air" data, preferably with all information (Gaze to pen location distance, etc.)
- 2. Build pauses
- 3. Extract other kind of data as "before".

The reason is that until you build pauses, there is no "Up" pause, only pen mouvements above the writing surface.

Except for "In Air" mouvements, most of the extraction menus assumed that pauses have been build beforehand. Not doing this may lead to incoherent results, although nothing will prevent you from doing this.

#### Audio data recording

We added a continuous audio recording, allowing paradigm such as verbal protocol, or context recording (sounds provided by another source during recording, such as bips, question/answers, etc.).

#### <u>Parallel port data input / output</u>

We added the ability to send/receive triggers through the parallel port, or event to continuously record data incoming to a parallel port. For this, we install a special driver (inpout32).

#### Templates for sequences

We added the ability to build templates for sequences description. Description in templates can be hierarchically organized. We hope this could be a convenient way to "normalize" descriptions across protocol sequencing, but also across a staff of people sharing protocol analysis.

#### Replay a model file for acquisition

We add the ability to export tablet data as model file that can be used as a dynamic stimulus in a script-based acquisition. In short, one may show a drawing/writing to a participant. An example could be showing how to write a word to a child. The model was written by a teacher, and filtered to smooth tracing.

Since the model is saved in a text file, you may edit this file. For example, one may replace some location or pressure values with mean values calculated on repeated writing of the same word. Or even create an artificial drawing from scratch.

You'l find more on this topic in this manual and in the Script reference manual.

#### GENERAL REMARKS

In this section, we introduce a number of notions that are used throughout this manual. To make the latter less cumbersome, they are not defined elsewhere.

In this manual, the terms "folder" and "directory" mean exactly the same thing.

#### 1. Real time experiment

Recording a huge amount of data in real time requires the computer managing this task to be 100% available. Evidence suggests that this is not the case of a computer running Microsoft Windows.

Nevertheless, it is possible to optimize recording conditions, by disabling antivirus software, automated updates and on-line chat applications (msn©, aim© etc.), unplugging or deactivating unnecessary devices, etc.

#### Caution:

Windows **themes** and **special effects** (blinks, sounds, etc.) may reduce acquisition quality by creating unforeseeable system response delays.

Switch to Windows "classic mode" and/or turn off Windows themes (or Aero).

Windows Firewall will prevent Netsync from working properly. We advise you to disable this firewall for the duration of the data acquisitions.

The Eye and Pen Web site (<u>http://www.eyeandpen.net</u>) provides a number of hints on this topic.

#### 2. Picture files

Eye and Pen supports the BMP, EMF, GIF, ICO, JPG, JPEG and WMF file formats wherever a picture file may be required (configuration, acquisition, script, etc.).

#### <u>Note</u>

The BMP file format is the only one that is not compressed. This means that saving a given picture in BMP format will result in a greater file size than it would in other formats (e.g. JPG), but its loading time will be shorter because there will be no uncompressing. This fact should be taken into account when choosing file formats for an experiment.

When a file is selected via a dialog box, the latter will show a preview of the selected picture.

**Important**: the bigger the picture and the greater the number of colors, the longer it will take to load and display.

p File selection: Background picture	A	
🕞 💭 🗢 📕 🕨 Bibliothèques 🔸 Documents 🔸 Mes documer	nts → EP_Dev → stimuli	- 4 Rechercher dans : stimuli
Organiser 🔻 Nouveau dossier		≣ ▼ □ 0
Mes documents Audacity BB FlashBack Exports BB FlashBack Pro Updates Downloaded Installations Ductus DVDFab Embarcadero E P_Dev ExperimentBuilder Examples E Set and Pen 2 Fax InterVideo E LiveCodeSamples MATLAB My Experiments My Experiments My Setup Nokia Suite Notes	Bibliothèque Docu Organiser par : Dossier * stimuli Nom agaige.bmp big.dig.bmp big.dig.g afraise.bmp	
Nom du fichier : bkgnd.jpg		<ul> <li>All pictures (*.bmp;*.emf;*.gif;* </li> <li>All pictures (*.bmp;*.emf;*.gif;*.ico;*.jpg;*.jpeg</li> </ul>
		Bitmap (*.bmp) Enhanced Windows Metafile (*.emf) Gif (*.gif) Icon (*.ico) Jpeg (*.jpg) Jpeg (*.jpg) Windows Metafile (*.wmf)

Figure 1: Picture selection dialog box.

#### 3. Tablet coordinate representation

This representation is also applicable to "screen" coordinates and to the definition of rectangles.

LABEL	DESCRIPTION		
x1y1  x2y2	X1 and Y1 coordinates correspond to the <b>upper left-hand corner</b> of the tablet's active area. X2 and Y2 coordinates correspond to the <b>lower right-hand corner</b> of the tablet's active area.		
X1	Coordinate of the left edge of the tablet's active area. This point is the horizontal <b>coordinates origin</b> .		
¥1	Coordinate of the upper edge of the tablet's active area. This point is the vertical <b>coordinates origin</b> .		
X2	Coordinate of the right edge of the tablet's active area (equal to the width of the tablet's active area).		
¥2	Coordinate of the bottom edge of the tablet's active area (equal to the height of the tablet's active area).		

To select coordinates on the tablet, click on the 🔜 icon.

A dialog box shows up, with 4 fields containing coordinates values.

Zone	selec	tion			
×1	0	۲	Y1	0	
X2	0	۲	Y2	0	
		ОК		Ca	ncel

Figure 2: Selecting coordinates on the tablet.

Press the pen in the upper left-hand corner of the area you wish to select on the tablet (X1Y1). Keeping the pen pressed down, slide it to the lower right-hand corner of that area (X2Y2), then lift it up.

The zone (area) coordinates will be updated in the dialog box fields. You can restart this selection process as many times as you like.

When you are satisfied, click on the "OK" button to validate.

**Hint:** to define a zone on a tablet, you can also stick a "Post-it®" (or something similar) onto the tablet, or even draw the desired zones in a picture. Then, either use this picture as a background picture ("*background picture*" option of the "*display*" tab in the acquisition configuration panel if you are using an LCD tablet), or print it out and lay it on top of the tablet.

### I. HARDWARE

## I.1. Requirements

Component	Requirement	
System	Windows Vista, Windows 7, 8, 8.1 & 10. You will have to use a user account with administrative rights to be able to install and use Eye and Pen.	
RAM	min. 4Go with Windows 32 bits.	
Free disk space	50MB for a complete installation (with samples), plus space needed for recordings and analyses.	
Graphics adapter	Min. 16 MB of video memory. Min. resolution 800x600. For greater comfort, we recommend 32MB and a resolution of 1024x768.	
Tablet	A Wintab32-compatible driver (see <u>Appendix</u> for a list of manufacturers). This driver will normally have been supplied with your tablet.	
Others	<ul> <li>Eye tracker (optional).</li> <li>"Eye &amp; Pen" supports the following eye trackers: <ul> <li>Applied Science Laboratories ASL504 (serial);</li> <li>S. R. Research Eyelink, Eyelink II or Eyelink 1000;</li> <li>S.M.I. iViewX</li> </ul> </li> </ul>	

#### I.2. Tablet installation



Figure 3: A tablet connected to a laptop.

STEP	DESCRIPTION
1	Switch your computer on.
2	Connect the tablet to your computer (follow its user manual instructions). <u>Important</u> : if it is to be taken into account in "Eye and Pen", the tablet must be <b>Wintab32-compatible</b> (see <u>appendix</u> ) or be a TabletPC.
3	<ul> <li>Install your <u>tablet driver</u>.</li> <li>Set your tablet up following the instructions in the user manual supplied with your tablet.</li> <li>Simply plugging the tablet the fact that it can be used in Windows is not enough to have it to work properly in Eye and Pen. The tablet's driver is to be installed anyway.</li> </ul>
4	<ul> <li>Set the tablet in absolute mode. The tablet will then return the pen's "true" coordinates, rather than a relative position.</li> <li>The "absolute mode" option may vary from one tablet to another. For Wacom tablets, for instance, the name of the option is "stylus mode". Check your tablet user manual.</li> <li>To obtain the maximum sampling rate, select the "recognition data" option (no dual track) if it is available.</li> <li>Here again, the name of this option may vary, so check your tablet user manual.</li> </ul>

#### I.3. Eye tracker installation

Following the instructions in the eye tracker's manual, connect it (or its data transmission device) to the computer executing Eye and Pen.

For example, Eyelink will be linked to your computer through a network cable, whereas ASL504 will transmit its data via a serial cable connected to a free COM port on your PC. Read the manufacturer's instructions carefully and use your eye tracker in accordance with its guidelines, including the safety instructions.

**Note:** to support Eyelink I, users must update the interface library (Eyelink Display Software) to version 2 (contact S.R. Research if in doubt).



Figure 4: The Eye and Pen PC "drives" the tablet and receives the eye-tracking data.

#### I.4. Eye & Pen installation

STEP	DESCRIPTION
1	Download the Last Eye and Pen release from the Eye and Pen web site ( <u>http://eyeandpen.net/download-en/latestrelease-en/</u> ).
	Launch EP3_install.exe from your Internet browser's download folder, and follow the instructions.
2	Follow the program instructions to install Eye and Pen. It will also try to install the Inpout32 driver (parallel port driver).
3	Launch the software: Start menu/Programs/Eye and Pen 3/EP

#### I.5. Starting Eye and Pen

There are three ways of launching Eye and Pen:

- click on "Start", select "Programs", then "Eye and Pen 3" folder. Click on "Eye and Pen" to start the program;
- go into the "Eye and Pen" software directory (default is c:\Program Files\Eye and Pen 3) and click on "EP.exe".
- on subsequent uses of Eye and Pen : double-click on a data file in Windows Explorer (filename has a extension TAB) or on an analysis file (filename has a TWK extension).

When launching it for the first time, the configuration panel will be displayed to let you select the language (drop-down list in the frame labeled "*Language selection*")

Language selection			
	Welcome !		
	English	•	
	Ok		

Figure 5: Selecting the application language.

#### Command line:

The program may also be launched through a command line (Start menu/Execute or in a "command prompt" window), with or without options. Type in the following command:

<hard drive name>:\<software directory path>\ep.exe [option1][option2]...[option n]

Options are:

#### [-f <.tab or .twk filename>]

Directly opens a "file.tab" file (for a new analysis) or a "file.twk" file (to resume an ongoing analysis).

[-c <conversion format>]:

Converts a raw tab file to one of the following formats: *DUCTUS*, *EP2* (*previous version of Eye and Pen*) *or TEXT* 

#### [nosplash]

Do not display Eye and Pen splash screen at start (launch is faster).

Example 1: to open the "participant1.tab" file without the Eye & Pen logo. C:\Program Files\Eye and pen 3\ep.exe -f c:\mydata\participant1.tab nosplash

<u>Example 2</u>: to re-open "participant23.twk", the analysis of participant23 (Eye & Pen logo will be displayed).

C:\Program Files\Eye and Pen 3\ep.exe -f c:\mydata\participant23.twk

```
Example 3:converts "participant23.twk" into a Ductus compliant file.
C:\Program Files\Eye and Pen 3\ep.exe -f c:\mydata\participant23.twk -c
DUCTUS
```

#### [NetSync]

Launches Eye and Pen as a Netsync "slave" (see Netsync chapter).

#### [script]

Starts recording in Script mode. Options are: –P <participant> -S <script> -G <participant group>

*Example*: Starts script recording with script "MyScript.txt" for participant "Toto" and group "A". C:\Program Files\Eye and Pen 3\ep.exe SCRIPT -S MyScript.txt -P Toto -G A

#### [simple]

Starts recording in Simple mode. Options are: -P <participant> -G <participant group>

*Example*: Starts script recording for participant "AZ223" and group "4". C:\Program Files\Eye and Pen 3\ep.exe SIMPLE -P AZ223 -G 4

The order of the options does not matter.

SCRIPT or SIMPLE options allows to launch Eye & Pen directly openning the matching menu item. Thus, one may use batch scripts (like ".BAT" files in DOS/Windows) to manage experiments using various software, including Eye and Pen.

#### **II. DEVICES CONFIGURATION**

(File/Configuration/Edit menu)

The configuration panel has 8 tabs, allowing users to configure acquistion :

- the tablet being used;
- the connected eye tracker;
- an audio recording device;
- the "Simple" acquisition paradigm ;
- script-based data acquisition;
- In / Out trigger management;
- script-based data acquisition, network synchronized;
- the display parameters.

To launch the configuration panel, click on the *"File"* menu, select *"Configuration"* and click on *"Edit"*.



Figure 6: Launching the acquisition configuration panel.

**Note:** for the sake of data consistency, some of the options of this panel cannot be modified when a protocol analysis is in progress.

## II.1. Tablet configuration

(File/configuration/edit menu, "Tablet" tab)

Tablet	Tablet
Eye tracker Audio Simple Script InOut Network Display New analysis Analysis Protocol Visualisations Tools Application	Interface         ● None       1 • WACDM Tablet (LCD)         ● TablePC         ● Wintab32         Timing mode         ● Eye and Pen       • Tablet driver         Specifications         ● Filter redundant data         ● Filter redundant data         ● Seyse and Pen       • Value returned by tablet driver may not be correct         Pressure levels       102 • • • • • • • • • • • • • • • • • • •

Figure 7: configuration panel, "Tablet" tab.

LABEL	DESCRIPTION
Interface	<ul> <li>Choose the type of tablet:</li> <li>None: an acquisition can be performed without a tablet.</li> <li>TabletPC: you will use the internal screen of a Tablet PC</li> <li>Wintab32: generic interface for external tablets connected to the computer.</li> </ul>
Timing mode	<ul> <li>Choose the origin of sample timestamp:</li> <li>Eye and Pen: samples are timestamped when delivered to Eye and Pen</li> <li>Tablet driver: the original samples timestamps. This is supposed to be the closest to sampling timing mode, with the less lag.</li> </ul>
	Before choosing a timing mode, we advise to perform some tests, because history showed that reality is sometimes different from theory. For example, measured sampling rate is not that anounced by manufacturer, or the driver performs some memory management operations involving sending samples in the wrong order when pen

	is up, etc. To help, Eye and Pen includes an option to check (and try to correct) samples timestamps for consistency (see further).	
	With TabletPC interface, only Windows timestamp is used because Electronic Ink mechanism timestamps each stroke (defined as the samples between two pen ups) from zero, which is not suitable for Eye and Pen.	
Tablet	Allows you to choose a tablet amongst those recognized by the Wintab32 driver in a scroll down list as in the following example:	
	2 - WACOM Tablet (LCD) 1 - WACOM Tablet 2 - WACOM Tablet (LCD)	
	<b><u>Important</u></b> : when a tablet is selected, its frequency, resolution and active area coordinate fields are automatically filled in. You can manually modify these values.	
Filter redundant data	If this option is ticked, the program will not record identical tablet data (successive samples with the pen at the same place with the same pressure).	
Sampling rate (HZ)	The tablet's sampling rate represents the number of times per second that pen data (coordinates and pressure) are sent by the tablet. <b>Note:</b> for Tablet PC, its value is always 133 Hz because the system does not always return a true value. You may use the performance test to empirically fix this value (p. 39). You may change it by hand.	
Resolution	These fields show the selected tablet's horizontal and vertical resolutions. You can manually change the values.	
	These values are involved when converting calculation results into measurement units (mm, cm, inches, etc.).	
Pressure levels	Range of the pressure measurement scale.	
Tablet Coordinates	This option shows the tablet's active area coordinates. You can manually change theses values.	
(in tablet intes)	If you are using a <b>double</b> screen (LCD tablet plus a standard monitor), see <u>Appendix</u> .	
Cartesian orientation	This option allows you to choose the type of coordinate system used by the tablet (check your tablet's user manual).	
bottom of the tablet)	If your tablet uses a <b>Cartesian system of coordinates</b> (the origin of coordinates is located in the lower left-hand corner of the tablet), check this box.	
	The program will then update the tablet data to align it on the screen coordinates system, which has its origin in the upper left-hand corner. If there is an error, the tablet data will be displayed "upside-down"	
	Standard tablets (non-LCD) generally use a Cartesian system,	
	whereas LCD (Liquid Crystal Display) tablets use a screen	

<b>coordinates</b> system (as they are also a screen).
This option is checked by default for Wintab32 devices and unchecked for Tablet PC.

#### II.2. Eye tracker configuration

(File/Configuration/Edit menu, " Eye tracker " tab)

Once the acquisition configuration panel has appeared, click on the "Eye tracker" tab.

C:\Users\chesnet\AppData\Local\E	P_DevFull\EPFull.ini
Tablet	Eye tracker
Eye tracker	☑ Use eye tracker
Audio	Model
Simple	Eyelink I & II (S.R. Research)
Seriet	Filter redundant data
Script	Sampling rate (Hz) 500 🚡 [maximum 1000 Hz]
InOut	Trigger eyetracker calibration
Network	On screen calibration
Display	x1y1
New analysis	(in pixels)
Analysis	Manage calibration screen
Protocol	Display a picture on screen
Visualisations	Position in window X 0 😴 Y 0 😴
Tools	File name point.bmp
Application	Wait for Esc key press to close calibration screen
	On non-LCD tablet calibration
	If calibration surface doe not cover the whole tablet, calibration limit on tablet (in tablet units)
	OK Cancel

Figure 8: Acquisition configuration panel, "Eye tracker" tab.

The *"Eye tracker"* tab shows three frames:

- "*Eye tracker model*": choose the eye tracker you are using from the list;
- "On screen calibration": for calibration on a PC screen or an LCD tablet;
- *"On non-LCD tablet calibration"*: for calibration on a standard tablet.

LABEL	DESCRIPTION	
Use eye tracker	This option allows you to choose whether you want to use an eye tracker or not.	
	If this option is selected (ticked), the <i>"Eye tracker model"</i> options become available.	
	You can select the eye tracker model from the drop-down list below the option. Four models are available: <b>Eyelink (I, II and 1000), ASL504,</b> <b>iViewX</b> and <b>Tablet.</b>	
	<b>Important:</b> if you wish to use an eye tracker that is not listed, leave a message on the Eye and Pen web site.	
	<ul> <li>This button allows you to set the eye tracker parameters.</li> <li>If you are using: <ul> <li><u>Eyelink</u> I and II: see page 27;</li> <li><u>ASL 504</u>: see page 28;</li> <li><u>iViewX</u>: see page 29;</li> <li><u>Tablet</u>: see page 31.</li> </ul> </li> </ul>	
Filter redundant data	This option allows you to discard successive items of identical eye data (the eye is still watching the same location). With a very accurate and high-speed sampling eye tracker, this option is not particularly useful, as our eyes move slightly all the time. On the other hand, a less accurate eye tracker with a low sampling rate may return many identical eye positions when the eye is in a "stationary" state.	
Sampling rate	Represents the number of times per second that the eye tracker samples the eye position. This value has to be set manually, as many eye trackers do not return this value, and some may have more than one sampling rate available.	
Trigger eye tracker calibration	Allows you to manually launch the eye tracker calibration. This option has no effect for EyePuter and ASL504, they do not have a remote "triggerable" calibration procedure.	

### II.2.2. Eye tracker configuration ("Parameters" button)

#### a) Eyelink I, II and 1000 (S.R. Research)

(*File/Configuration/Edit* menu, "*Eye tracker*" tab, "*Eyelink I and II*" model, then "*Parameters*" button)

$\epsilon_{\rm P}$ Eyelink I & II configuration	X
General Record Evel ink file (* EDE into EDE sub-folder)	
Trecold EyeLink nie ( .EDF, into EDF subfolder)	
Link port Ethernet	
Calibration	
Target diameter (pixels)	
Hole diameter (pixels) 3	
Target color	
Background color	
Drift test position	
Horizontal (pixels) 50 🚗	
Vertical (pixels) 400 😴	
Binocular mode restriction	
<ul> <li>Right eye</li> </ul>	
	Cancel

Figure 9: Eyelink parameter configuration.

The configuration panel for "Eyelink I and II" contains four frames, called:

- *"General"*: overall parameters ;
- *"Calibration"*: calibration parameters (driven by the Eyelink host PC);
- "Drift test position": set the position of the drift prompt on screen;
- *"Binocular mode restriction"*: choice of the recorded eye;

The "General" frame options are described in the following table:

LABEL	DESCRIPTION
<b>Record Eyelink file</b> (*.EDF, into EDF sub- folder)	If this option is ticked, data recorded in the " <i>Eyelink Data Viewer</i> " format (Eyelink host PC) will be transferred to the Eye and Pen PC.
Link port	For the time being, only the Ethernet link is supported.

The "Calibration" frame options are described in the following table:

LABEL	DESCRIPTION
Target diameter (pixels)	Calibration target diameter. Size of the "point" the participant has to look at for calibration.
Hole diameter (pixels)	Diameter of the "hole" in the middle of the calibration target.
Target color	Calibration target color.
Background color	Calibration window background color. This can be changed via the button shown to the right side.
	<b>Hint:</b> to enhance calibration, choose a background color similar to the one that will be used with the protocol displays.

The "*Drift test position*" frame allows you to set the horizontal and vertical position (in screen pixels) of the target shown on screen.

Clicking on the urrent screen center.

"Eye and Pen" only records data for one eye. The "*Binocular mode restriction*" frame option allows you to choose which eye (left or right) will be recorded.

b) ASL -504 (Applied Science Laboratory)

(*File/Configuration/Edit* menu, *"Eye tracker"* tab, *"ASL 504"* model, then *"Parameters"* button)

C:\Users\chesnet\AppData\Local\	EP_DevFull\EPFull.ini
Tablet	Eye tracker
Eye tracker	✓ Use eye tracker
Audio	Model
Simple	ASL504 (Applied Science Laboratories)
Script	Sampling rate (Hz) 500 🕃 [maximum 1000 Hz]
InOut	Trigger eyetracker calibration
Network	ASL-504 configuration
Display	ASL504
New analysis	Serial port COM1 -
Analysis	Free head (MHT device)
Protocol	Baud rate 57600 -
Visualisations	X resolution 255 😴
Tools	Y resolution 263 🖨
Application	OK Cancel
	On non-LCD tablet calibration

Figure 10: ASL-504 parameter configuration.

LABEL	DESCRIPTION
Serial port	Select your port from 9 possible COM ports.
Free head (MHT device)	If you want to use a head movement compensation device (if the eye tracker has one), tick this option.
Baud rate	Select the serial transmission speed.
X resolution	Select horizontal eye tracker resolution (consult the manufacturer's technical specifications).
Y resolution	Select vertical eye tracker resolution.

## c) iViewX (S.M.I. GmbH)

(*File/Configuration/Edit* menu, "*Eye tracker*" tab, "*iViewX*" model, then "*Parameters*" button)

Connection para	meters				
🥅 Save N	′ew⊠ file (*.ID	F)			
Link	port Ethern	et	•	]	
Local host IP	100.1.1.	2	Port	5555	\$
NiewX host IP	100.1.1.	1	Port	4444	\$
Calibration					
Number	of calibration	points	<b>_</b>		
		Contraction (			
Uses planes					
<ul> <li>Uses planes</li> <li>Planes definitio</li> </ul>	n				
<ul> <li>Uses planes</li> <li>Planes definition</li> <li>Number of planes</li> </ul>	n anes	1 🔹			
<ul> <li>Uses planes</li> <li>Planes definitio</li> <li>Number of planes</li> </ul>	n anes Number	1 🔹 Width (mm	) <u>H</u>	eight (mr	1)
<ul> <li>Uses planes</li> <li>Planes definitio</li> <li>Number of planes</li> <li>Plane 1</li> </ul>	n anes Number 0 主	1 € Width (mm	) H	eight (mm	1
<ul> <li>Uses planes</li> <li>Planes definitio</li> <li>Number of plane</li> <li>Plane 1</li> <li>Plane 2</li> </ul>	n anes Number 0 🔹	1 🔹 Width (mm 0 📫	) H I O I O	eight (mm	
<ul> <li>Uses planes</li> <li>Planes definitio</li> <li>Number of plane 1</li> <li>Plane 2</li> <li>Binocular mode r</li> </ul>	n anes Number 0 🔹	1 🔹 Width (mm 0 🛔	) н 5 р 5 р	eight (mm	
<ul> <li>Uses planes</li> <li>Planes definition</li> <li>Number of plane 1</li> <li>Plane 1</li> <li>Plane 2</li> <li>Binocular mode mode mode</li> <li>Left eye</li> </ul>	n anes Number 0 🗲 0 🗲 estriction	1 🔹 Width (mm 0 🔮	) н 1 р 1 р	eight (mm	

Figure 11: iViewX parameter configuration.

The configuration panel for "iViewX" contains four frames, entitled:

- "Connection parameters": settings to connect it to the eye tracker;
- *"Calibration"*: calibration configuration;
- *"Planes definition"*: parameters to set if your iViewX model records eye data relative to 3D planes (e.g. the HED-HT model);
- *"Binocular mode restriction"*: choice of the recorded eye.

The "Connection parameters" frame allows you to determine how the Eye and Pen computer

will "talk" to the iViewX computer. Options are described in the following table.

LABEL	DESCRIPTION
Save iViewX data file (*.IDF)	If this option is ticked, data will also be recorded on the iViewX host PC, in the "iViewX" format.
Link port	Only the Ethernet link is supported, for the time being.
Local host IP (and port)	Internet protocol address of the network adapter of the computer executing Eye and Pen. "Port" is the port number that will be used to communicate with the iViewX computer
iViewX host IP (and port)	Internet protocol address of the network adapter of the computer executing Eye and Pen. "Port" is the port number defined in the "Ethernet" configuration of the iViewX.

To achieve maximum communication efficiency, we suggest that you connect both computers' network adapters using an Ethernet crossover cable (recent computers may also use an ordinary cable), removing any other network connection, and using the following parameters (menu Start/Parameters/Network connections of Windows):

- "Eye and Pen" computer: IP address 100.1.1.2, subnet mask 255.255.255.0, neither gateway, nor DNS nor WINS.
- ✤ iViewX computer: IP address 100.1.1.1, subnet mask 255.255.255.0, neither gateway, nor DNS nor WINS.

In the iViewX software, select **Ethernet** in the "**Remote**" dialog box of the **Setup-Preferences-Hardware** menu. In the **Config** tab, select the Ethernet address and port. To allow Eye and Pen to send commands to iViewX, select the **Enable Data Streaming** option in the **Online** menu.

The "*Calibration*" frame options are described in the following table.

LABEL	DESCRIPTION
Number of calibration points	Number of points used for calibration You may choose 0, 1, 2, 5, 9 or 13 points. If you wish to let iViewX use its own calibration, choose 0 points

If your iViewX uses 3D planes (e.g. the HED-HT device), tick the "Use planes" checkbox and fill in the fields of the frame below.

The "*Planes definition*" frame allows you to configure parameters for each individual plane.

LABEL	DESCRIPTION
Number of planes	Number of planes (1 or 2) whose data will be read by Eye and Pen.
Plane 1 (number, width, height)	Number of the iViewX plane from which Eye and Pen is to read data, and its horizontal and vertical dimensions in millimeters.

Plane 2			
(number,	width,	height)	

If you are going to use two planes (as in the illustration below), several restrictions apply:

- Plane 1 must be located above plane 2;
- Both planes must be left-aligned;
- Planes can be of different widths;
- > Planes 1 and 2 must lie in vertical proximity (contiguous).



Figure 12: Setting up two planes.

"Eye and Pen" only records data for one eye. The "*Binocular mode restriction*" frame option allows you to choose which eye (left or right) will be recorded if your eye tracker is in binocular mode.

## d) Tablet (pen tracking)

#### (File/Configuration/Edit menu, " Eye tracker " tab, "Tablet" model)

Strictly speaking, this is not an eye tracker, but rather a means of recording the movements of the pen across the tablet's surface as though it were eyetracking data. Thus, all pen movements within the tablet's detection area are recorded, even when the pen is raised ("in the air"). To a certain extent, this can help you to "see" where the pen goes during up pauses.

This "model" has no parameters to configure, so the "Parameters" button is inactive (shaded).

This "eye tracker"'s sampling rate is that of the tablet and its calibration onto the screen dimensions is matched to the display coordinates (Script tab).

Recording is matched as closely as possible to the requested sampling rate, whether or not there is new tablet data.

<u>Note</u>

When used in conjunction with the "masking" mode (cf. Display configuration), where the participant has to use the pen in order to be able to read the text on the screen (unmasking the display by moving the pen above the tablet's surface), you may end up with what amounts to the "poor man's eye tracker"!

When the pen moves out of the tablet detection area, data are fixed to -100,-100 pixels ("out of field").

II.2.3.	Eye tracker	calibration	configuration
	-		

("On screen calibration	and "On non-LCD	tablet calibration'	'frames)
-------------------------	-----------------	---------------------	----------

	Eye tracker
Eve tracker	☑ Use eye tracker
Audio	Model
Simple	Eyelink I & II (S.R. Research)
Soript	Filter redundant data
Script	Sampling rate (Hz) 500 😴 [ maximum 1000 Hz ]
InOut	Trigger eyetracker calibration
Network	On screen calibration
Display	ст. X1V1— X1 0 🖀 Y1 0 🖀
New analysis	(in pixels)
Analysis	
Protocol	Manage calibration screen
Visualisations	
Tools	File name Doint bmp
Application	Wait for Esc key press to close calibration screen
	On non-LCD tablet calibration
	If calibration surface doe not cover the whole tablet, calibration limit on tablet (in tablet units)

Figure 13: Acquisition configuration panel, "Eye tracker" tab.

#### a) Calibration on screen

Details of the "On screen calibration" frame are given below:

LABEL	DESCRIPTION
Coordinates on screen (in pixels)	This option allows you to set the calibration grid coordinates. Click on the " <b>Whole screen</b> " button to use the entire screen surface.
Manage calibration screen	Set if Eye and Pen should provide a window (screen) for calibration (this is the case for Eyelink) or if the eye tracker manages the situation on his own.
Use a	Displays a background picture when calibrating (on screen).

picture	The followi	ng steps will help you to use this option.
	STEP	DESCRIPTION
	1	Tick the "Use a picture" option.
	2	Select the picture you want to be displayed during calibration (click on the "folder" icon). The path to this file is displayed to the right of the " <b>Filename</b> " label.
	3	Enter the picture's upper left-hand corner horizontal coordinates (in pixels, relative to the display window) into the " <b>X</b> " box.
	4	Enter the picture's upper left-hand corner vertical coordinates (in pixels, relative to the display window) into the " <b>Y</b> " box.
	The horizon hand corner	ntal and vertical coordinates represent the location of the upper left- er of the picture in the calibration window.

## b) Calibration on non-LCD tablet

When calibrating on a non-LCD tablet (i.e. a tablet with an opaque surface, such as the one you can lay down on a desk), ask the participant to look sequentially at points drawn on a sheet of paper (laid on top of the tablet).

To learn how to calibrate your eye tracker correctly on the tablet, get in touch with your eye tracker reseller helpdesk.

Next, select the calibration limit on the tablet (this limit is zero by default).

Only leave the calibration limit at zero if you are using a **conventional tablet** and your calibration covers the tablet's entire surface.

If you are using a **tablet and a PC screen and want to record eye movements on both surfaces**, read the following section to find out how to define a calibration limit.

## Why set a calibration limit?

Simply because using a non-LCD tablet and a computer screen has several limitations.



Figure 14: A tablet and a PC screen recording device.

On the one hand, the calibration area is restricted because most eye trackers are only able to make accurate recordings of eye positions within a 30° horizontal and 20° vertical range (angle " $\alpha$ " on Fig. 15). Indeed, depending on the size of the screen and tablet, the calibration area may be assigned to only part of the screen and/or tablet.

On the other hand, because the tablet and the screen are not aligned in the same plane, the distance (depth) between each hardware device and the eye will vary. This variation can entail a decrease in recording accuracy. This is because eye trackers measure eye movements as though the watched scene was flat and perpendicular to the line of sight. With a device like the one shown in Figure 10, the eye-fixated point will be miss-estimated because of the angle between the tablet and the "theoretical" plane of vision (angle " $\beta$ " on Fig. 15). In order to minimize the error, angle " $\beta$ " has to be reduced as much as possible, by aligning the tablet and screen surfaces.

When the distance between the eye and the device prevents the participant from seeing the entire surface of the screen and the tablet, the calibration has to be restricted to the visible area (depending on the participant's vision and/or eye tracker's range). In this case, part of the task environment must be ignored. The vertical limit of this ignored area is referred to as the "calibration limit".



Figure 15: Calibration limit.

The steps to calculate the vertical calibration limit are described below.

STEP	DESCRIPTION
1	Click on the " <del>*</del> " icon to the right of the " <i>On non-LCD tablet calibration</i> " frame.
2	Touch the bottom of the calibration surface (calibration limit) with the pen (tablet stylus). The calibration limit value will be updated.
3	Click on the "OK" button. Mission accomplished.

## II.3. Audio recording device

(File/Configuration/Edit menu, "Audio" tab)

C:\Users\chesnet\AppData\Local	\EP_DevFull\EPFull.ini		
Tablet	Audio		
Eye tracker	Medel		
Audio	Miuses stérés (Positele	High Daf	
Simple	Mixage steleo (nealter		
Script	Sampling rate (Hz)	11025	
Scipt	Resolution (bits)	16	
InOut	Channels	mono	
Network			
Display			
New analysis			
Analysis			
Protocol			
Visualisations			
Tools			
Application			

Figure 16: Audio recording configuration.

LABEL	DESCRIPTION
Record audio input	When this option is ticked, any tablet recording (Simple or script « OpenRec » command) will also trigger continuous audio input recording. Audio recording will be stopped when tablet recording will stop.
	Data are saved in a file with the same name as the tablet data file and the ".wav" extension.

The "*Model*" frame described below shows you the audio input device characteristics. Yet, this frame is descriptive only, you can not change these values since Eye and Pen sets it so to limit file size for voice recording.

LABEL	DESCRIPTION
Model	Audio input name as provided by Windows system. This device may be changed within Windows system configuration.
Sampling rate	The number of samples recorded by second. Eye and Pen uses 11025 Hz.
Resolution	The quality of sampling, i.e. the number of bits to code each sample by channel: 8, 16or 24 bits, for example. In Eye and Pen, the resolution is set by design at 16 bits (some hardware behaves baddly in 8 bits resolution).
Channels	The number of channel used: mono (1) or stereo (2). Eye an dPen uses mono.

## II.4. In / Out device

C:\Users\chesnet\AppData\L	.ocal\EP_DevFull\EPFull.ini	<u> </u>
Tablet	- InOut	
Eye tracker	Parallel port	
Audio	Port address (hexa) 0378	
Simple	Lines state is reversed (Low is +5v)	
Script	✓ Use data register (pin 2-9) to receive values (port is ECP)	
InOut	Continuously record port input	
Network		
Display		
New analysis		
Analysis		
Protocol		
Visualisations		
Tools		
Application		

(File/Configuration/Edit menu, "InOut" tab)

Figure 17: parallel port configuration.

The "*Parallel port*" frame allows you to determine how the Eye and Pen computer will "manage" the computer parallel port. Options are described in the following table.

LABEL	DESCRIPTION
Port address	This is the parallel port address, as reported by Windows device manager (see Howto below).
Line state is reversed	Some devices communicating via the parallel port uses reverse states on lines (wires). This is the case for Cedrus Stimtracker, for example (see Appendix XIII for details).
Use data register	When this option is ticked, pins 2-9, usually used to send data, will be used to receive data. This behavior should only be set on ECP parallel port. Either, you mat build a special wire able to use other pins to receive data with limited range (see appendix XIII for details).
Continuously record port input	When this option is ticked, any tablet recording (Simple or script « OpenRec » command) will also trigger continuous recording of port input. Port event recording will be stopped when tablet recording will stop.
	Note : continuous recording disable scripts command for port input or output, since port is locked on listenning for inputs.
	Data are saved in afile with the same name as the tablet data file and the ".ext" extension.
### How do I get Port Adress ?

- 1. Open Windows Device manager.
- 2. Select Ports (COM and LPT).
- 3. Open the device of your choice. In the example below, I have a build-in parallel port ECP Printer Port (LPT1).
- 4. To get the address of this later, I open its property panel, select the Resources tab. The address requested is the first number of the first line: 0378.

Bevice Manager	
File Action View Help	
🗢 🔿 📰 🔲 📓 🖬 😣 🗎 😽 🐻	
EyeLink-Host-PC     Disk drives     Display adapters     Display adapters     DVD/CD-ROM drives     Floppy disk drives     Toppy disk drives     DVD/CD-ROM drives     Toppy drive controllers     DVD/CD-ROM drives     Top drive controllers     Mice and other pointing devices     Monitors     Network adapters     Monitors     Network adapters     Other devices     Portable Devices     Ports (COM & LPT)     Communications Port (COM1)     ECP Printer Port (LPT1)     Processors     Sound, video and game controllers     System devices     Universal Serial Bus controllers	ECP Printer Port (LPT1) Properties       X         General Port Settings Driver Details Resources         ECP Printer Port (LPT1)         Resource settings:         I/O Range 0378 037F         I/O Range 0778 077F         DMA 03         Setting based on:         Current configuration         I/O conflicts.

Figure 18: retrieving parallel port address in Windows.

If you have an ExpressCard Parallel Port it may be labeled "PCI Express ECP Parallel Port". Its address will also be the first number, for example 1100 in the xample below.

PCI Exp	ress ECP Parallel Port (LPT3)	
Resource settings	н:	
Resource type	Setting	
I/O Range	1100 - 1107	=
I/O Range	1108 - 110B	
		*

Figure 19: retrieving another parallel port address in Windows

### **III. DEVICE TESTS**

Eye and Pen has functions that enable you to test the tablet and the eye tracker by two means:

- a visual test;
- a performance test.

The availability of the entries of the Device Test menu is determined by the acquisition devices being selected or not.

### III.1. Tablet tests

### III.1.1. Tablet visual test

#### (Device tests/Tablet/Visual menu)

This function allows you to check visually how the tablet is working within Eye and Pen. A background picture or the background color is displayed (select from the *File/Configuration/Analysis* menu, "*Display*" tab).

Moving the pen across the tablet will leave a trace on the screen. The value defined in "File/*Configuration/Edit* menu, *Analysis* tab, *Draw a line between points*" is used to display the test. Either pen positions are « linked » with a line, or each pen position sampled by the tablet is plotted (no line between points), thereby giving a direct visual indication of data quality.

When moving the pen across the tablet, pen pressure and coordinates (horizontal=X, vertical=Y) are displayed at the top of the screen.



Figure 20: Visual tablet test.

To leave or end this test, you can either:

- press the "Escape" key;
- press the pen in the rectangle labeled "End" (see option "Show trigger zones" in <u>Analysis configuration p. 54</u>).

## III.1.2. Tablet performance test

### (Device tests/Tablet/Performance menu)

The performance test simply consists in tracing a continuous line on the tablet. When you lift up the pen, an effective sampling rate is calculated.

Tablet performance	×
1120 data received in 7953 mill Sampling rate: 141 Hz	iseconds.
	ОК

Figure 21: a Tablet PC performance test.

This test may be used for example, to determine a Tablet PC sampling rate.

## III.2. Eye tracker tests

III.2.1. Eye tracker visual test

(Device tests/Eye tracker/Visual menu)

This menu allows you to view the gaze position over the calibration grid (on screen). It helps you to check the calibration visually.



Figure 22: Visual eye tracker test.

Once you have calibrated your eye tracker, you should be able to see a cross (at the gaze position) "moving with your eyes" (center of figure), as it is measured by the eye tracker. To cancel the test, press the "Escape" key.

### III.2.2. Eye tracker performance test

#### (Device tests/Eye tracker/Performance menu)

This menu allows you to estimate the data sampling rate as recorded by "Eye & Pen". When you launch this function, a message will be displayed at the top of the screen, asking you to wait for 15 seconds.

A message box will then display:

- the amount of data received per millisecond;
- the eye tracker's sampling rate.

Click on the "*OK*" button to end the test.

### III.3. Audio tests

(Device tests/Audio menu)

This menu allows testing the audio input recording feature. This requires that "Record audio input" is selected in the configuration panel (see figure below).

C:\Users\chesi	net\AppData\Local\EP_Dev	Full\EPFull.ini		
Tablet	Au	dio		
Eye track	er 🔽	Record audio input		
Audio	M	odel Misrophone (USP. Pr	P Sound Douis	
Simple		Sampling rate (Hz)	11025	
Script		Resolution (bits)	16	
InOut		Channels	mono	
Network				

Figure 23: Audio recording settings.

A level meter displays an indication of the intensity of sound recorded by the microphone.

Figure 24: audio input Level meter.

### III.4. Network message tests

#### (Device tests/Network message menu)

This tools allows to send a text message between Eye and Pen and another computer within the same subnetwork (IP and ports settings are set within Eye and Pen configuration panel).

€ <sub>P</sub> Network me	ssaging test		
Local IP Port	195.220.222.6 50010	Distant IP Port	195.220.222.1 50011
Message	to send		Send

Figure 25: sending a message over the network between 2 computers.

Type a message in the "Message to send" field, then click on the "Send" button.

### III.5. I/O tests

#### (Device tests / I/O menu)

This panel allows testing data input or output through the computer's parallel port (or what gives a parallel port interface, such as an ExpressCard or PCMCIA card).

$\epsilon_p$ Parallel port test		<u>X</u>
Mode	Continuous reading	
Send	0000000	
Receive	Line n° 8 7 6 5 4 3 2 1 value	
	Start Stop	
	Data sending	
	Line n° 8 7 6 5 4 3 2 1	
	value 7 🗭	
	Send	

Figure 26: sending a value through the parallel port.

The "Mode" panel allows to choose if you wish to test the port to send or to receive data.

- 1. You selected "*send*". To enable a data line, click on the "spot" showing the line number. To disable a line, click it again. Alternatively, you may type a value in the "Value" field. In the example above, the value "7" set lines 1, 2 and 3 high.
- 2. You selected "*Receive*". 8 LED shows lines state: high or low. Click on the "Start" button to start continuously reading parallel port for data, and "Stop" when finished.

### IV. DISPLAY CONFIGURATION PARAMETERS

(File/Configuration/Edit menu, "Display" tab)

C:\Users\chesnet\AppData\Local\	EP_DevFull\EPFull.ini
Tablet	Display
Eye tracker	Acquisition and analysis
Audio	Background picture
Simple	L:\Users\chesnet\Documents\LP_Dev\stimuil\retractation.PNG
Script	Left 0 💭 Top 0 💭
InOut	Background color
Network	Pen tracing color #0000000 🕥 Width 1 😴
Display	Acquisition
New analysis	Wask production feedback (display)
Analysis	Unmasking point.bmp 💦
Protocol	Screen fill-in 💿 Color
Visualisations	Picture     point.bmp
Tools	Blur Intensity
Application	Display coordinates (in pixels) Select screen
	x1y1 X1 0 😴 Y1 0 😴 Screen 1 👻
	x2y2 X2 1320 🕞 Y2 1080 😴 Tablet 1:1 ratio
	Analysis
	Screen display (pixels) Width 1024 😴 Height 1024 😴 🔣
	OK Cancel

Figure 27: Acquisition configuration panel, "Display" tab.

The "*Display*" tab contains three frames:

- *"Acquisition and analysis"*: displays defaults parameters common to the acquisition and analysis modules;
- *"Acquisition"*: selects parameters specific to the Simple and Script modes of acquisition;
- "Analysis": displays parameters specific to the analysis.

LABEL	DESCRIPTION	
Background picture	You can select a background picture by clicking on the folder icon. The path and name of this file will be displayed to the right of the label.	
Left / Top	Allows setting coordinates (in pixels) of the picture's upper left corner, relative to the upper left corner of the display.	
Background color	Select a background color for the display. <u>Note</u> : if you select a background picture that is as wide as the screen, the background color will not be visible.	

Pen tracing color	Select the color of the trace left by the pen on the screen.	
	A sample of the current color is shown to the left of the button. Its color number is written over the sample (useful for indicating a color in a script).	
	<u><b>Caution</b></u> : if the tracing color is the same as the background color, it will not be visible.	
Width	Width of pen tracing on screen, in pixels.	

The "*Acquisition*" frame described below allows you to set the acquisition only display parameters, be they Simple or Script.

LABEL	DESCRIPTION	
Mask production feedback (display)	If you do not wish the screen content to be directly visible, check this option.	
Unmasking	Select a picture file that will be used to "make visible" that which is not visible in the immediate vicinity of the pen ("hole" in the mask).	
	An "umasking" file is a two-color (black and white) BMP format picture. The dark area represents the area around the pen location (the picture is centered on the pen's position). The white area represents the "peephole". In the following example, the unmasked part of the screen is elliptical and has been moved off-center to the left of the pen position, allowing the writer to see part of what has already been written.	
	Figure 28: A file used to unmask the display.	
	You will find several samples of files in the "Cursors" folder (the number in the filename indicates the "peephole" size in pixels).	
Screen fill-in	<ul><li>Select the screen masking mode you require:</li><li>picture (select a file)</li><li>color</li></ul>	
	• blur: the screen content is blurred. You can adjust the blurring intensity from 1 to 100%. Since the trace left by the pen is dynamically blurred, the higher the blurring level, the longer it takes to refresh the display.	
Display coordinates	This option allows you to set the display coordinates during an acquistion.	
	<i>Display coordinates (in pixels)</i> " allows you to define which zone of the screen will be used to display stimuli, messages etc. To use the entire screen, set X1 and Y1 to zero, and set X2 and Y2 to the horizontal and vertical screen resolution values.	
	For example, with a 1024 x 768 resolution, set to 0, 0, 1024, 768 (see FAQ: "How can I find out the current screen resolution?" p. 175), or select a screen (see next option).	

Select screen	A scroll-down list enables to select a monitor for display, amongst those available at this time. Selecting a screen sets display to its full screen coordinates.
Tablet 1:1 ratio	This button helps modifying display range to ensure that 1 cm on tablet is displayed as 1 cm on screen. It is only useful when a "classic" tablet has been selected: it has no meaning for a screen-tablet, a TabletPC device or no tablet at all.
	Please, enter width and height measurement of the display in mm Horizontal 677
	Ok Cancel         Figure 29: Mapping tablet to screen.         Just fill-in display size in millimeters, and the display size in pixels will be adjusted accordingly (see example below).         Display coordinates (in pixels)         Select screen $x_{191}^{1/2}$ $x_{2}^{1/2}$ $y_{1}^{1/2}$ Screen 1       Tablet 1:1 ratio         Figure 30: Display width and beight adjusted
	rigure 30: Display wiuth and height adjusted.

**Note:** specific script commands allow a broader range of mask manipulations, such as the definition of locations to mask/unmask, etc. (more about masking in the Script manual).

The "*Analysis*" frame allows you to configure display parameters that are only applicable for data analysis:

LABEL	DESCRIPTION
Width (pixel)	Width of the display window for later analysis.
Height (pixels)	Height of the display window for later analysis.
	Directly fills <b>"Width</b> " and " <b>Height</b> " fields with the current screen display resolution (defined in the Windows display properties – see Windows Configuration Panel).
	<u><b>Caution</b></u> : the higher the resolution and color number, the longer it will take to "refresh" the display and the greater the video memory load will be.

# V. ACQUISITION CONFIGURATION PARAMETERS

# V.1. Simple acquisition

(File/Configuration/Edit menu, "Simple" tab)

C:\Users\chesnet\AppData\Local\	\EP_DevFull\EPFull.ini	X
Tablet	Simple	
Eye tracker	Trigger zone 1	
Audio	☑ Use trigger zone 1	
Simple	Show at the beginning of recording	
Script	Picture point.bmp	
InOut	Zone coordinates on the tablet X1 42890 😴 Y1 1 😨	
Network	X2 54201 🕃 Y2 7757 🕃 🔤	
Display	Trigger zone 2	
New analysis	☑ Use trigger zone 2	
Analysis	Picture point.bmp	
Protocol	Zone coordinates on the tablet X1 27094 🕃 Y1 14626 🕃	
Visualisations	X2 30480 🕃 Y2 9434 🕃	
Tools		
Application	End trigger zone	
	Zone coordinates on the tablet X1 24430 🖨 Y1 18798 🕃	
	X2 30477 🕃 Y2 22821 🕃	
	☑ Display pen tracing on background	
	OK	Cancel

Figure 31: Configuration panel, "Simple" tab.

LABEL	DESCRIPTION	
Trigger zone 1	This option creates a rectangular zone on the tablet, allowing you to display a picture on the screen. This will be referred to from now on a <b>Trigger zone 1.</b>	
	In "simple acquisition" mode, if the participant presses the pen in a trigger zone, the selected picture is displayed on the screen. When the pen is released, the picture disappears.	
	When it is ticked, this option allows you to select:	
	• the trigger zone 1 coordinates on the tablet;	
	• the associated picture;	
	• the "Show at the beginning of recording" option;	
	• the " <i>Hide on first pen press</i> " option.	

Show at the beginning of recording	If this option is ticked, the picture "linked" to trigger zone 1 is displayed at the very start of data acquisition.
Hide on first pen	This option is only available if the preceding option has been activated.
press	If this option is ticked, the picture displayed at the start of recording is removed from screen when the pen is pressed on the tablet surface (i.e. typically when writing starts).
Picture	Allows you to select the picture "linked" to trigger zone 1 (click on the folder icon)
	The name and path of the selected picture are updated in the box labeled " <i>Picture</i> ".
	The picture is always displayed in the upper left-hand corner of the screen.
	According to its original size, the picture may cover only part of the screen (there is no resizing).
Trigger zone 2	Works in a similar way to trigger zone 1, except that it has no "Show at the beginning" or "Hide on first" options.
Picture (trigger zone 2)	Works in a similar way to the picture for trigger zone 1
End trigger zone	Allows you to create a rectangular zone on the tablet. When the participant presses the pen on it, the recording stops.
Zone coordinates on the tablet	Allows you to set tablet coordinates for trigger zones (in tablet lines). Click on the 🔜 icon to select the area on the tablet.
Display pen tracing on background	If this option is ticked, the participant's writing (or drawing) will be displayed on the screen.

## V.2. Script-based acquisition configuration

(File/Configuration/Edit menu, "Script" tab)

C:\Users\chesnet\AppData\Lc	ocal\EP_DevFull\EPFull.i	ni				X
Tablet	Script					
Eye tracker	Folders					
Audio	Stimuli	C:\Users\chesnet\Do	ocuments\EP_Dev\stir	muli\	8	
Simple	Data	C:\Users\chesnet\Do	ocuments\EP_Dev\da	ta\	8	
Script	Scripts	C:\Users\chesnet\Do	ocuments\EP_Dev\sc	ripts\	8	
InOut	Models	C:\Users\chesnet\Do	ocuments\EP_Dev\mo	odels\	8	
Network						
Display	Text display					
New analysis	Text font a	nd color #00	0080			
Analysis	Text backg	ground color #80	8080			
Protocol			MS Sans	s Serif 1	8	
Visualisations	l ext sampl	e				
Tools						
Application	Start zone					
		For the state to be to	V4 20E0 👁	V1 250 🖼	5	
	∠one coord	dinates on the tablet	XI 2300 🕞	YI 300 🕞		
			X2 3072 😨	YZ U G		
				ſ	01	
					UK	Cancel

Figure 32: Configuration panel, "Script" tab.

The "Script" tab contains three frames:

- *"Folders"*: names of the directories of recorded data and the stimuli used;
- *"Text display"*: text display parameters;
- "*Start zone*": start zone coordinates on the tablet.

The "*Folders*" frame contains all the parameters needed to define the names of the directories containing data recordings and the stimuli that have been used.

LABEL	DESCRIPTION
Stimuli	Select the folder containing the stimuli used for script-based acquisition (pictures, movies, texts and / or sounds).
Data	Select the folder in which the data is to be recorded.

Scripts	Select the folder containing the script(s) to execute. When in a NetSync session, this folder's content will be announced (listed) to the Master host.
Models	Select the folder containing the "Model files" used for script-based acquisition and Templates files for sequences description.

The "*Text display*" frame contains the parameters needed to define how texts will be displayed with a script.

LABEL	DESCRIPTION		
Text font and color	Allows you to select default parameters for <b>text</b> and <b>message displays.</b> You can set:		
	• color;		
<b>1</b>	• font;		
	• size;		
	• underline or strikeout style.		
	When selecting a color (click on button), the new color and its color number are displayed to the left of the button.		
	The color number is used in some script commands.		
Text background color	Allows you to select the default background color for text displays. When changing the color (click on button), the color and its number are updated to the left of the button.		
	The color number is used in some script commands.		
Start zone	The " <i>Start zone</i> " frame allows you to define a default start zone on the tablet. When calling up the corresponding command in a script, the script will remain "on hold" until the participant presses the pen in this zone (see p. 16, Coordinate representation).		
	You can set tablet coordinates for trigger zones manually or by clicking on the icon to select the area on the tablet with the pen.		

## V.3. NetSync: network-managed "Script" acquisition

(File / Configuration / Edit menu, "Network" tab)

C:\Users\chesnet\AppData\Loc	:al\EP_DevFull\EPFull.ini	X
Tablet	Network	
Eye tracker	NetSync network	
Audio	Master IP adress 192.168.10.100 -	
Simple	Dialog port 50000 💭	
Script	Transfer port 50021 💭	
InOut	NetSync Macter ontions	
Network	Download a copy of NetSync clients data in the folder:	
Display	C:\Users\chesnet\Documents\EP_Dev\data\	
New analysis	[ Free disk space on unit C: 29 % (67260 Mb) ]	
Analysis		
Protocol	NetSync Client options	
Visualisations	Update Stimuli and Scripts folders from Master's folders	
Tools	Messaging network	
Application	Local IP 195.220.222.6    Local port 50010	
	Distant IP 195.220.222.1 Distant port 50011 😴	
		Cancel

Figure 33: Configuration panel, "Network" tab.

The "*Network*" settings includes four frames:

- *"NetsSync network"*: parameters required for a "Client" host to be able to communicate with the "Master" host, and synchronize and transfer data;
- "NetSync Master session options": options used by the "Master" host.
- "NetSync *Client session options*": options to determine for a "Client" host.
- "Messaging network": options to send messages to another computer.

The "*NetsSync network*" frame contains all the parameters required to enable communication to take place between the Master host and the Client hosts. This information should be the same on both the Master host and the Client hosts.

LABEL	DESCRIPTION
Master IP address	Network address of the Master host. This address can be typed in. On the Master host, the scrolling list shows the host's local network address.
Dialog port	Port number used to manage communication (messages) between the Master host and the Client hosts.

Transfer port	Port number used to copy (FTP) data files to and from the Master host and the Client hosts.
	nost and the Chefit hosts.

All the available port numbers lie within the 50000-65535 range, i.e. the range authorized for "private" use on networks (see <u>https://www.iana.org/assignments/service-names-port-numbers/service-names-port-numbers.xhtml</u>).

The "*NetSync master options*" frame contains parameters specific to the Master host. Thus, these options have no effect on client hosts.

LABEL	DESCRIPTION
Download a copy of NetSync client's	Tick this option if you want the data collected during the acquisition session to be copied to the Master host.
data 🔁	Next, click on the folder icon to designate the destination folder.

The "*NetSync client options*" frame presents the option **Update Stimuli and Script folders from Master's folder.** Tick this option if you would like the *Script* folder (as defined in the *Script* tab) and the *Stimuli* folder to be updated with the content of the *Stimuli* and *Script* folders of the Master host. Only missing or older files are updated.

The "*Messaging network*" frame contains all the parameters required to enable communication to take place between the local host and a distant computer.

LABEL	DESCRIPTION
Local IP address	Network address of the computer. This address can be typed in or selected in the scrolling that shows the host's local network address.
Local port	Port number used to manage communication (messages) on the local computer.
Distant IP	Network address of the computer you intend to talk to. This address has to be typed in.
Distant port	Port number used by the distant computer to manage communication (messages).

## VI. DATA ANALYSIS CONFIGURATION PARAMETERS

Once the data acquisition is complete, the data analysis tools will help you to sort, code, discard, cluster, etc. The options in this panel can be modified at any time.

### VI.1. New analysis configuration

(File/Configuration/Edit menu, "New Analysis" tab)

C	C:\Users\chesnet\AppData\Local\EP_DevFull\EPFull.ini				
	Tablet	New analysis			
	Eye tracker	Tablet data			
	Audio	V Try to correct invalid data (timestamp order, etc.)			
	Simple	Fix sampling rate (Hz) at			
	Script	Convert pressure level to Up and Down states			
	InOut	Up state pressure level thresold (0/1023) 3			
	Network	🕅 Aggregate successive pen data into the same tablet zone (simple acquisition)			
	Display	🕅 Filter data			
	New analysis				
	Analysis	Eye data			
	Protocol	Warning if Eve data are missing			
	Visualisations	Code 1 out of Kald oue date			
	Tools	☐ Cude - i ouroi-neu eye data ✓ Aggregate successive ouroi-field eve data			
	Application				
		If an AUI file exists for current background picture, apply to eye data			
		Acquisition devices			
		O Use original acquisition parameters			
		Use current acquisition parameters instead			
		OK Car	ncel		

Figure 34: Configuration panel, "New analysis" tab.

This tab shows three frames labeled:

- "Tablet data": parameters for tablet data treatment;
- *"Eye data"*: parameters for eye tracking data;
- "Acquisition devices";

Parameters for the "*Tablet data*" frame options are explained below:

LABEL	DESCRIPTION
Try to correct invalid data	Tick this option to check and correct sampling defects, such as wrong timestamps, wrong sample orders, etc.
	Correction sequence is:
	1. check for last pause
	2. sorting data, based on timestamps

	3. fixing data with same timestamp, distributing as much as possible remaining samples within the time range. If this is not possible, samples in excess are removed.
Fix sampling rate at	Try to correct sampling rate errors, for example when acquisition sampling rate (recorded with data) is not matching the true data sampling rate of data.
Convert pressure level to Up and Down states	Transforms pressure exerted by the pen on the tablet into a bi- level state: the pen is either "up" or "down". By default, a pressure level of zero corresponds to a pen "up" state. Any other value corresponds to a pen "down" state and is then set to 1023 (maximum pressure).
	This can be compared to the process of converting a picture in a monochrome series of grays into a black-and-white picture.
	<u><b>Caution</b></u> : the pressure scale may vary from one tablet model to another.
Up state pressure level (0/1023)	Allows you to define the threshold pressure value for the "up" state of the pen.
	For example, if the pen does not leave a trace on the paper until the pressure exceeds a value of 3 or 4, you can set the threshold to this value.
	<b>Important:</b> this option is only available if the " <i>Convert pressure level</i> " option has been ticked.
Aggregate successive pen data	If this option is ticked, successive data items in the same trigger zone will be turned into a single data item.
in the same tablet zone	All the participant's moves in this zone will be clustered within a single point.
(simple acquisition)	This option is useful when, for example, a participant moves slightly when pressing the pen in a trigger zone. A series of moves then becomes a single press.
Filter data	Apply the filter scheme selected in <i>File/Configuration/Edit</i> menu, <i>Tools</i> tab.

The parameters for the "*Eye data*" frame options are described below:

LABEL	DESCRIPTION
Warning if eye data are missing	This option is only useful only if you are using an eye tracker. Otherwise, do not tick it.
	If you have ticked it, a warning message will be displayed if the protocol's eye-tracking data are not found.
	<b>Important:</b> if you are not using an eye tracker, do not tick this box.
	This option may be useful for signaling a data management problem, for example when only a part of a participant's files

	has been moved to a new directory.
Code -1 out-of-field eye data	Data with coordinates beyond the calibrated area are automatically coded as -1.
Aggregate successive out-of- field eye data	This option is only available if the above option has been ticked. This option allows you to aggregate (cluster) successive data beyond the calibrated area. These items will not be taken into account in the analysis, but will enhance the initial data duration with the sum of all subsequent discarded data. It is useful to reduce the amount of data when, for example, the participant is thinking with his/her eyes "gazing skywards".
If an AOI file exists for current background picture, apply to eye data	If an AOI <sup>1</sup> file exists with the same name and in the same directory as the background picture (e.g. "backgnd.bmp" and "backgnd.aoi"), this option allows you to automatically load and apply AOI zone coding to the eye data.

The "*Acquisition devices*" frame allows you, either to use the original device(s) configuration parameters that were in use when the protocol was recorded, or to use the current devices configuration instead (which may not be the same).

Since these parameters includes devices resolutions and sizes, this will have consequences on data display and later calculations (you can see which parameters are included in file headers in <u>Appendix</u>).

As a rule, it is advisable to use the original configuration parameters.

<sup>&</sup>lt;sup>1</sup> An AOI is a visual Area Of Interest (see p.79)

## VI.2. Analysis configuration

C:\Users\chesnet\AppData\Loo	cal\EP_DevFull\EPFull.ini	X
Tablet	Analysis	
Eye tracker	Presentation	
Audio	Eye cursor C:\Users\chesnet\EP\EP_De	ev\cursors\cross.bmp
Simple	Pen cursor C:\Users\chesnet\EP\EP_De	ev\cursors\pencil.bmp
Script		pauses color
InOut	Final	
Network	Final	
Display	Show In Air movements as watermark	
New analysis	Show pressure level	Show trigger zones (simple acquisition)
Analysis	Draw a line between tablet points	Show pictures (simple acquisition)
Protocol	Synchronize background picture and visual ze	ones (AOI)
Visualisations	Show picture/tablet separation position (in pixe	els) 0 🖨
Tools	🔲 Audio signal auto gain	
Application	Default sound file	
	C:\Users\chesnet\Documents	s\EP_Dev\stimuli\Windows-Ding.wav 📴
	Calculations	
	Units — (tablet counting unit)	
	<ul> <li>Measurement (centimeters or inches)</li> </ul>	
	Number of decimals 4	
		OK Cancel

(File/Configuration/Edit menu, "Analysis" tab)

Figure 35: Configuration panel, "Analysis" tab.

This tab shows two frames, labeled:

- "Presentation": parameters for data display options;
- *"Calculations"*: parameters for the calculation results;

The "*Presentation*" frame options are described below.

LABEL	DESCRIPTION
Eye cursor	Choose the icon that will materialize (show) gaze position on the screen.
	A cursor is a ".BMP" picture file, with a maximum of 256 colors.
	The first point (pixel) in the lower left-hand corner of the picture defines the color that will be replaced by transparency.
	For example, you can create a cursor with a circle shape corresponding to the participant's central vision, or fovea (consult fovea.bmp in the \cursors subdirectory to gain a better idea of what is "centrally" viewed.
Pen cursor	Choose the icon representing the pen's position on the screen.

Pause color	Allows you to change the color used to represent pauses on the screen (see p.88).
	Click on the button, select a color and the color sample will be updated to the left of the button.
Final product watermark color	This option allows you to see what the participant wrote as a background. The final product is then displayed as a watermark. Clicking on the button, you may then choose a particular color for the watermark. A sample of the selected color is displayed to the left of the button. Hint: to make the watermark disappear, choose a color that is similar to the background color.
Show In Air mouvements as watermark	This option allows you to display pen mouvements above the tablet (during pauses) in a specific color.
color	Allows you to change the color used to represent In Air pen mouvements on the screen.
	Click on the button, select a color and the color sample will be updated to the left of the button.
Show pressure level	Change the color of the pen's trace according to the amount of pressure exerted on the tablet (shades of gray). The greater the pressure, the darker the shade (0=white, 1023=black).
Draw a line between tablet points	This option allows you to draw a line joining up successive points. It makes the participant's writing easier to read. Unticking this option makes it easier to assess data quality in an initial analysis (number of points, etc.). The distance between the points will be related to the participants' writing (drawing) speed.
Synchronize background picture and visual zones (AOI)	Visual Areas Of Interest (AOI) are commonly defined with respect to the background picture. If the background picture is moved (cf. <u>Shift layers</u> , p.118), the AOI will no longer be in the right place. This option allows you to "link" the AOIs to the background picture. That way, if the background is moved, the AOI will move with it.
Show picture/tablet separation	Check this option if you are using a non-LCD tablet + screen (the tablet is located below the screen) and you are calibrating your eye tracker on the whole device (cf. diagram, p. 33) Displays a separation line between screen and tablet.

Position (in pixels)	Determine the position of the separation line, taking into account the physical position of the two devices. Click on the button, fill in the fields of the dialog box and click on " <i>OK</i> ".	
	€ <sub>P</sub> Calculate	
	Picture/tablet separation	
	Display height (cm) 22,8	
	Vertical display resolution (pixels)	
	Distance from bottom of picture to tablet top (cm) 12,4	
	OK Cancel	
	Figure 36: Physical separation between screen and tablet dialog box.	
Audio signal auto gain	Enable automatic gain calculation for audio playback to have an amplitude of the signal high enough, but not too much (remains audible without saturation).	
Default sound file	If this option is checked, a default sound file will be loaded with the protocol, if the protocol does not has one. You may select the default sound file (11Khz, mono, 16 bits wave file required). Example of use: you recorded handwriting during a dictation. You may re-use the dictation sound file to help analyse the production.	
Show trigger zones (simple acquisition)	If this option is ticked, trigger zones will be displayed in the background during analysis. In general, it is advisable to keep this option ticked.	
Show pictures (simple acquisition)	If this option is ticked, the picture linked to a trigger zone will be displayed when the pen data "enters" into this zone. It mimics the participant's behavior.	

Parameters in the "*calculations*" frame are described below:

LABEL	DESCRIPTION
Units	This frame allows you to select the unit of measurement for the calculation outputs. There are two possible values:
	• in lines, the tablet's "natural" unit of measurement;
	• in centimeters or inches, depending on the tablet's resolution and the driver's measurement system.
Nunber of decimals	Set the number of decimals for non integer values extracted (distances, speed, etc.).

# VI.4. Protocol configuration

(File/Configuration/Edit menu, "Protocol" tab)

Users\chesnet\AppData\L	ocal/EP_DevFull/EPFull.ini	
Tablet	Protocol	
Eye tracker	Description	
Audio	Separate Up and Down pauses	
Simple		
Script		
InOut		
Network		
Display		
New analysis		
Analysis		
Protocol		
Visualisations		
Tools		
Application		
		Jancel

Figure 37: Configuration panel, "Protocol" tab.

The only option yet available is: do you want Up and Down pauses to be treated as "just pauses" or be processed as two separate sorts of pauses in the sprotocol statistics.

## VII. VISUALISATIONS CONFIGURATION

C:\Users\chesnet\AppData\Local\I	EP_DevFull\EPFull.ini
Tablet	Visualisations
Eye tracker	Circles
Audio	Pauses color
Simple	Fixations color
Script	✓ Display eye movements
InOut	☑ Link circle size to duration
Network	Circle size (in pixels)
Display	Fill circles with color
New analysis	AOI scanpath
Analysis	V Number hxations
Protocol	
Visualisations	
Tools	
Application	Colors
	Foveal vision diameter on screen (in pixels) 31 🕃
	Gaze to pen distance threshold (in pixels) 64 🕃 🥫
	Color when gaze to pen distance is beyond threshold
	OK Cancel

(File/Configuration/Edit menu, "Visualisations" tab)

Figure 38: Configuration panel, "Visualisations" tab.

The "Visualisations" tab shows two frames, labeled:

- "Circles": set colors to represent data projection on screen;
- *"Colors"*: parameters specific to this preview mode;

The "Circles" frame allows you to set:

Pauses color	Select a color to represent tablet data (click on the button). A sample of this color will be shown to the left of the button
Fixations color	Select a color to represent eye data (click on the button). A sample of this color will be shown to the left of the button.
Display eye movements	If this option is ticked, previews like "temperature" will include all eye movements' data, whether it is fixations or simple eye movements.
Link circle size to duration	If this option is ticked, the diameter of the circle will grow according to the duration represented. The longer the fixation / pause, the greater the diameter. [ diameter = $(Log_2(Duration) * log_{10}(Duration)-1) / 2$ ].

	If this option is unticked, you may set a unique circle size.
Circle size	Set an arbitrary size (in pixels) to all circles.
Fill circle with color	Should the circles representing fixations be filled with color? If the answer is "yes", tick this box. Then, click on the subtron select a new color. The current color is shown to the left of the button.

**AOI scanpath**: successive fixations in the same AOI are summed up and the "point" is plotted at summed fixations barycenter location coordinates. Obviously, if you want this preview to be meaningful, fixations (see p. 99) and AOI (see p. 122) should have been calculated and defined first.

Number fixations	Fixations are numbered in chronological order, which allows you to make their order visible.
Draw a line between fixations	Each circle, representing a fixation, is linked to the next one with a line. This visualization may help to follow a scan path.

The "*Colors*" frame options are described below:

foveal vision diameter on screen	This option allows you to specify the foveal (central) vision project size on screen (in pixels). To set this value, click on the state but The following dialog box will then be displayed:	
	€ <sub>P</sub> Calculate	
	Picture/tablet separation Display height (cm) 22,8	
	Vertical display resolution (pixels)	
	Distance from bottom of picture to tablet top (cm) 12.4	
	OK Cancel	
	Figure 39: Calculation of foveal vision diameter on screen.	
	Fill the boxes with the requested values and click on the "->" button. When satisfied, click on the " $OK$ " to validate. The projection of the foveal vision will then be calculated and displayed to the left of the " <i>Calculate</i> " button.	
Gaze to pen distance threshold	This option allows to set a threshold to the distance between gaze and pen location on screen. Click on the same procedure as the option above.	
Color when gaze to pen is beyond threshold	Click on the solution to select the color used to represent data when the distance between gaze and pen locations is greater than the threshold. The idea is to represent when gaze if far away from pen position on the protocol. If in air mouvements are available, they will be taken into account.	

## VIII. CONFIGURING TOOLS

ablet	Tools	
Eye tracker	Word separation	
Audio	Word begin code	10
Simple	Word end code	11
Script	Inter-word pause code	9
nOut	Code Up pause before first word	t
Network	Number of lines for description	3
Display	Separator between texts	1
New analysis	Include Up pause preceding wo	ord into sequence
Analysis		Above 1
Protocol	Padding between word and AOI	Left -1 🕞 Right 1 🕃
/isualisations	(in pixels)	Below 1
Fools	Tob data	œ
	Filter	utterwenth -
-ppneadon		
	Pauses building Se	e options 🗾 🔯
	Eve data	
	Fixations building Ba	arycenter 🔹

Figure 40: Tools parameters.

The "*Tools*" tab includes the options for three Tools menu sub-items.

The "*Word separation*" frame allows you to set the default values for the tool of the same name.

The "*Tab data*" frame allows you to set the default filtering method for tablet data and the default pauses building method.

The "Eye data" frame allows you to set the default method to build fixations.

The options of the "*Word separation*" frame are described below:

LABEL	DESCRIPTION
Word begin code	Code that will be attributed to the first tablet datum for each word. This code can be modified for each individual word when performing step 2.
Word end code	Code that will be attributed to the last tablet datum for each word. Once again, this code can be modified when performing step 2.
Inter-word pause code	Code attributed to the pause(s) preceding each word.

Code Up pause before first word	This option allows you to determine whether the pause before the first word is to be coded or not. In most cases, this pause is the pre-writing pause, so you may want to exclude it from the automatic coding.
Number of lines for description	Number of text lines available to describe each separated word (from 1 to 6).
Separator between texts	You may decide to insert separators between the lines of description for each word ("Text" lines). In this case, the description lines for each word will be assembled together with the separators to create a single descriptor that can be used to generate sequences.
Include Up pause preceding word into sequence	If this option is ticked, the pause preceding the word will be included in the sequence as its start timestamp.
Padding between word and AOI	When creating AOI for each "word" previously separated, you may enlarge the AOI by a number of pixels, in each of the four directions.

Word separation data are automatically saved / loaded with the protocol. The file has a "WDS" extension (*<ParticipantName>*.WDS) and is saved in the same folder as the analysis data file. It is automatically loaded (if it does exist) whenever the analysis is reopened. This WDS file can be manually deleted (without any risk for the analysis).

The options of the "*Tab data*" section are described below:

LABEL	DESCRIPTION
Filter	Currently, only one filter is proposed: a Butterworth filter. You may set its parameters, clicking on the button. For more details, see chapter 3 "data analysis".
Pauses building	Clicking on the button, you may select which type of pause you want to build, Up or Down (stationary). You can select amongst three methods to build down pauses. For more details, see chapter 3 "data analysis".

The options of the "*Eye data*" section are described below:

LABEL	DESCRIPTION
Fixations building	Barycenter Barycenter Multi-threshold Speed This scrolling list proposes 3 algorithms to build fixations from eye mouvements data. Each can be tuned clicking on the button. For more details, see chapter 3 "data analysis".

## IX. APPLICATION PARAMETER CONFIGURATION

(File / Configuration / Edit menu, "Application" tab)

C:\Users\chesnet\AppData\Local	\EP_DevFull\EPFull.ini	_ XX
Tablet	Application	
Eye tracker	Interface	
Audio	Language English 🗸	
Simple	Color model LightBlue	
Script		
InOut		וה
Network	Show Reservings alw	
Display	Show necoraings any	
New analysis	Environment	
Analysis		
Protocol	Confirm save analysis on exit	
Visualisations	Confirm file overwriting	
Tools	3 🕞 Undo levels	
Application	5 🕞 Items in the most recently used files list	
	Associate TAB and TWK files with Eye & Pen (requires administrative privileges)	
	OK Car	ncel

Figure 41: Application parameter settings.

The "Application" tab includes two frames:

- *"Interface"*: select language and toolbar appearance, and session log items selection;
- *"Environment"*: general software settings;

The options of the "*Interface*" frame are explained below:

LABEL	DESCRIPTION
Language	This option allows you to select the software interface language in a scrolling list (English ≡ or French ■).
Color model	This scrolling list allows you to select a "color model" to personalize the toolbars look and feel (Pauses, Fixations, Sequences, etc.).

	<u>Note</u> :
	<ul> <li>This option uses a special folder named "Toolbars", containing the color models.</li> <li>Each model is made of a sub-folder (named after the color model name) containing pictures and icons for toolbars (as BMP format pictures), and a file named "Toolbars.ini" describing the background color and type font involved. The "Toolbars" folder contains a file named "ColorModelsHowTo.txt" explaining how to build your own color models.</li> </ul>
Session	Allows to select what information will be shown when opening a session log: all events or only the recording files subset.

The "*Environment*" frame allows you to set specific behaviors:

Give a feedback when a processing is over	If this option is ticked a message will be displayed when some processing ends, for example capturing the protocol into a picture or clustering eye movements into fixations.
Confirm save on exit	If this option is not ticked, the analysis will automatically be saved, without any prompt. Otherwise, you will be asked to decide whether you want the analysis to be saved or not.
Confirm file overwriting	Allows you to activate / deactivate the overwrite confirmation prompt messages when attempting to save over an already existing file.
	<u>Note</u> : Although the warning speaks about file replacement, when it come to text files (data extraction, etc.), data are appended to the existing text file.
	Deactivate this option may be useful in particular cases, for example to simplify data extraction automation.
	In the usual case, it is advisable and safer to leave this option ticked.
Undo levels	Set the number of successive actions that can be cancelled.
Items in the most recently used files list	Set the maximum number of filenames (saved analysis) displayed at the bottom of the File menu when scrolling down. Admitted values ranges from 0 to 128.
Associate TAB and TWK files with "Eye and Pen" (Windows registry)	Allows you to directly launch "Eye and Pen" when you click on a ".TAB" data file or a ".twk" analysis file (details in appendix IX).

### X. SAVE / LOAD CONFIGURATION PARAMETERS

When you use "Eye and Pen", the last parameters to have been used are reloaded by default.

If you wish to use more than one configuration, you can **save** current parameters under a new name before modifying them. You will then be able to reload them later.

To do this, click on the *"File"* menu, select *"Configuration"* and click on *"Save as"*. The following dialog box will then be displayed:

$\epsilon_{\rho}$ Save as	p Save as					X
OO V Iocalad	Search Eye and Pen 3					
Organize 🔻 New fol	der				:==	• 🔞
☆ Favorites	Name	Date modified	Туре	Size		
🧮 Desktop	EP.ini	04/01/2018 09:53	Configuration sett	6 KB		
Downloads	EPkeys.ini	24/12/2010 16:55	Configuration sett	1 KB		
ibraries E Documents Music Fictures Videos						
P Computer SYSTEM (C:) Removable Disk ( Removable Disk (						
File name: EP.i	ni					•
Save as type: Con	figuration file (*.ini)					•
) Hide Folders				[	Save	Cancel

Figure 42: Saving the configuration parameters.

Choose a filename and a directory and save your configuration parameters (".ini" file type) clicking on the "*Save*" button. The file has now been saved.

To **open** a parameter file, click on *"File"*, select *"Configuration"* and click on *"Open"*. The following dialog box will then be displayed:

P Open							
🔾 🗸 🕨 🕨 localadmin	🔾 💭 🗸 📕 🕨 localadmin 🕨 AppData 🔸 Local 🕨 Eye and Pen 3 🖉 👻					3	٩
Organize 🔻 New folder	r				!≡ ▼		0
☆ Favorites	Name	Date modified	Туре	Size			
🧮 Desktop	EP.ini	04/01/2018 09:53	Configuration sett	6 KB			
〕 Downloads	🗃 EPkeys.ini	24/12/2010 16:55	Configuration sett	1 KB			
Recent Places							
Cibraries							
Documents E							
Initial C     Initial C							
Videos							
🖳 Computer							
🏭 SYSTEM (C:)							
👝 Removable Disk (							
🖵 numerisation (W							
🖵 Laboratoires (Y:)							
🖵 localadmin (\\M: 🍸							
File na	me:			-	Configuration file (*.in	ii)	•
				(	Open	Cancel	

Figure 43: Loading the configuration parameters.

Select an ".ini" configuration file and click on "Open".

The configuration parameters contained in this file will immediately be activated.

## **Default configuration**

If necessary (e.g. you misconfigured some parameters), you can **reload** the Eye and Pen **default parameters**.

To do so, click on *"File"*, select *"Configuration"* and click on *"Reload defaults"*. Default configuration parameters will now be activated.

To save **current parameters as new default parameters** for Eye and Pen, click on *"File",* select *"Configuration"* and click on *"Save as default"*.

Note:

You cannot load a configuration file or the default parameters once an analysis is underway.

Otherwise, the parameters of the tablet, eye tracker and display, together with other parameters involved in the analysis might be modified and your analysis would be greatly compromised.

For this reason, if you wish to change the configuration file, close your analysis first.

## I. INTRODUCTION

## I.1. Acquisition modes

Data acquisition can be managed in tree modes:

- a so-called "Simple" acquisition mode, which is totally defined in the Eye & Pen configuration panel;
- an acquisition mode driven by a "Script", i.e. where all events are described through a pseudo command language. Certain basic parameters are set in the Eye & Pen configuration panel, but all the parameters may be redefined via the script.
- an acquisition mode driven by a "Script" and synchronized through a network: NetSync.

The "**Simple**" mode allows you to manage an acquisition according to the options selected in the configuration panel. For example, should a picture be displayed when the recording starts, should this picture be hidden as soon as the participant begins to write, etc. It may cover a range of experiments from sentences production, to picture description.

The ease with which Simple acquisition can be managed brings with it certain limitations, in that the options are limited to what is available in the Eye and Pen configuration panel.

So that you can run a more complex (or extended/varied, etc.) acquisition scenario, Eye and Pen also provides a "**Script**" mode.

A script is based on a programming mini-language that allows you to specify how the acquisition will take place and what will happen<sup>2</sup>. In short, it describes the acquisition scenario that Eye and Pen will have to process.

In practical terms, a script comprises a text file containing written commands and parameters that Eye and Pen will interpret and then execute: for example to play an audio stimulus, to wait until the pen is pressed in a tablet zone, to load a list of words to display on the screen, etc.

<sup>&</sup>lt;sup>2</sup> A script language is a programming language that allows control of functionalities of a computing system [...]. Script language can free from low level constraints [...] and benefit from a high level syntax.

A script language is most often executed from files containing the source code of the program that will be interpreted. Historically, they were created to shorten the traditional dveleopment process [...]. The first languages were oftenly called "command language" or "Job Control they allow you to automate a bunch of successive simple commands, like a "theater script" (translated from http://fr.wikipedia.org/wiki/Langage\_de\_script).

## I.2. Session logging

During a recording session, the main events of interaction with the participant (on-screen displays, audio/video playing, recordings, responses, etc.) are recorded in a ".log" text file, together with the time at which these events occur (time elapsed in milliseconds since the beginning of the recording session).

This Log may be used again later, when analyzing data.

Aside from the "standard" log file, some script commands allows to manage a custom log file.

## I.3. About timing

Data are recorded with a common time base, i.e. the time at which the PC executing "Eye and Pen" starts receiving the incoming data.

Although this system is not ideal (timing may be less reliable than that of the acquisition device because the data have to "travel through" the Windows system, resulting in additional and unpredictable delays), this mode was chosen to circumvent problems encountered with some drivers (tablet, and some other devices). Moreover, not all drivers (e.g., eye trackers) time-stamp their data.

In Eye and Pen 3, tablet data timestamp may also be retrieved from tablet driver (see devices configuration options, chapter 1) and be matched with the common timing base, thus allowing a higher timing precision on tablet data. Nevetheless, what was said above remains true: driver timestamps may not be liable, or available at all. Thus, it is advisable to perform some time accuracy checking before selecting this timing mode for a real experiment recording session.

## I.4. Acquisition environment

The tablet and optionally eye tracker and input device that you have selected and configured are activated as soon as data acquisition begins.

If the eye tracking system is capable of doing so, its calibration procedure is automatically and immediately launched at the start of data recording, without any request on your part.

For ASL504 (serial mode), you will have to carry out an independent calibration prior to acquisition.

The acquisition is monocular, i.e. only the right or left eye (cf. <u>Eyelink configuration panel</u>, p. 27).

<u>Abort an acquisition:</u> whatever your acquisition mode, a key press on the **F12** keyboard key will halt the acquisition as quickly as possible.

### II. "SIMPLE" ACQUISITION

### (File/Acquisition/Simple menu)

The "Simple" mode of acquisition allows you to record tablet and eye data (if you are actually using an eye tracker, of course) using the simple acquisition parameters defined in the configuration panel (Simple tab).

Acquisition		L X
Session		
Script	SIMPLE	13 🕢
Participant ID	test	]
Group		
	Do not overwrite previous recording	
	Go!	Quit

Figure 44: Simple acquisition dialog box.

A dialog box will appear, with some fields grayed out, because they are only used for the script acquisition mode.

LABEL	DESCRIPTION
Script	Displays the name of the current script. Only "Simple" is displayed in this mode.
Participant ID	Choose a name for the data file(s). Data will be saved in the directory defined in the configuration panel (Script tab).
Do not overwrite previous recording	This option allows you to avoid losing data from a previous recording if you mistakenly choose the same name. If this option is ticked and a data file with the same name already exists in the same directory, a warning will be displayed (recording start is canceled).
Go !	Launches acquisition.
Quit	Closes the acquisition dialog box and returns to the main Eye and Pen screen.

To end the session using the simple acquisition mode, you have two solutions:

- press the pen in the "end" trigger zone on the tablet (normal exit);
- press the "*Escape*" key or "F12" key ("emergency" exit).

### III. SCRIPT-BASED ACQUISITION

Acquisition based on script relies on a mini programming language.

This pseudo language is made up of a list of **commands** (see Script Reference manual for details).

These commands have to be written in a text-only file ".txt" (Windows ANSI coding).

A set of commands in a text file is called a <u>script</u>.

## III.1. Script-based acquisition dialog box

(File/Acquisition/Script menu)

When launching the script-based acquisition mode, a "start" dialog box is displayed on the screen.

Acquisition		
Session		
Script	PlayModel.txt	2
Participant ID	test	
Group	A 🔹	
	Do not overwrite previous recording	
	Go!	Quit

Figure 45: Script-based acquisition dialog box.

LABEL	DESCRIPTION			
Script	Displays the name of the current script.			
2	Allows you to select the script you want to use. <u>Caution</u> : a script file must be saved in "text-only" file format (".txt") if it is to be understood by Eye and Pen. By default, the last used script is proposed.			
	Modifies the current script or create a new one in the script editor.			
Participant ID	Choose a name for the data file(s).			
Group	Optionally, select a group to which the participant belongs to, in the scrolling list. This selection may be later retrieved from a script. This list may be modified by hand (see further).			
Do not overwrite previous recording	This option allows you to avoid losing data from a previous recording if you mistakenly choose the same name. If this option is ticked and a data file with the same name already exists in the same directory, a warning will be displayed (recording is canceled).			

Go !	Launches acquisition. First, the script is checked against major defects (syntax faults, missing files), then it is executed.
Quit	Closes the acquisition dialog box and returns to the main Eye and Pen screen.

## Group selection and management

To select a group for your participant, click on the arrow to the right of the group field. A list will scroll down. Click on the group name you want.

Acquisition		
Session		
Script	PlayModel.txt 💦 🖉	
Participant ID	test	
Group		
	A K	
	C	
		J
	Go! Quit	]

Figure 46: Scrolling down the group selection list.

# Add a group to the list

Type a new group name in the "Group" field. Then, click on the "+" icon.

Acquisition		<b></b>
- Session		
Script	PlayModel.txt	2
Participant ID	test	
Group	SpecialGroup1	
	Do not overwrite previous recording	Add to list
	Go!	Quit

Figure 47: Add a group name to the group list.

Scroll down the list to see the result.

Acquisition		×
Session		
Script	PlayModel.txt	🔊 🔊
Participant ID	test	
Group	SpecialGroup1	
	B P	2
	C SpecialGroup1	
	Go!	Quit

Figure 48: A new group name in the group list.

## Remove a group from the list

To remove a group name from the list, select it, then click on the minus button ("-").

4	Acquisition		
	Session		
	Script	PlayModel.txt	2
	Participant ID	test	
	Group	SpecialGroup1 -	
		Do not overwrite previous recording	Remove from list
		Go!	Quit

Figure 49: Removing a group name from the group list.

### III.2. Script editor

(File / Script editor Menu)

The script editor helps you to write commands by selecting values and filling in fields in dialog boxes. If a script file is named in the "Script" field of the script acquisition panel, it can be modified. If the panel does not already contain a name, a new file will be created.



Figure 50: Script editor menus.

The "*File*" menu shows the classical function to create a new script or re-open an previous one, save it: New, Open, Save, Save as and Quit.

The "*Edit*" menu has the usual functions of a text editor: Cut, Copy, Paste, Delete, Find, Replace, Select All and Cancel (last editing).

The "*Command*" menu allows you to select script commands and set their parameters with the help of dialog boxes where you fill in fields. Obviously, a script can also be written or modified "by hand".

Depending on the type of zone/area to be defined, selection will be done either with the computer mouse on the screen or else with the tablet pencil on the tablet. For some fields, a mouse right-click will open a list of suggestions, including labels found in the script, keywords and keyword combinations.

When it has been validated, the dialog box will write the command for you at the place where the text cursor is, with the values you have defined.

Commands are grouped by category.

The "*Script*" menu:

- "Check syntax" performs an automatic verification to ensure that the script is "well" written.
- *"Execution test"* checks that all the elements involved in the script (syntax, stimuli files, etc.) are ready.

The "?" menu:

• *"Help"*: shows what help is available for script acquisition
• *"Command list"*: provides a list of script commands

Once the script has been saved, its name is updated in the script acquisition panel.

# III.3. Script commands.

See Script reference manual.

# IV. NETSYNC

(File/Acquisition/NetSync Menu)

# **IV.1.** Presentation

Script-based acquisition can be managed in a network environment, thanks to the NetSync module.

This tool is designed to save time and enhance data security: instead of individual test sessions, it allows group sessions to be held and enables the entire volume of data that is created to be processed, all the while limiting risks of data loss.

The concept is based on a Client-Server architecture. It is built around two applications: a "controller" application, the so-called NetSync module, executed on the computer acting as a server (known as the "master host") and a client application undertaking data acquisition on the "Client host" computer.

The script that is to be executed on each individual "Client" host is selected from the "master host" application.

The pace at which the test is administered on client hosts can be controlled from the master host through a "client pause/authorization to continue from master" mechanism, thanks to a specific command inserted into the acquisition script.

When the scripted acquisition is over, data can be copied from each client host to the master host, where they are stored and organized according to the date and time of the session, the participant's name and the client host's name, thus preventing data from being overwritten.

NetSync is designed to act as a network "synchronizer", managing collective experiments. Client hosts' stimuli and scripts can be updated from the master host's own stimuli and scripts and their data can be copied to the master host when the acquisition session has ended.

Data acquisition is based on the client's local configuration (software and hardware).

# IV.2. Client

The client side application is simply the Eye and Pen launched with the command line parameter "NETSYNC".

Thus, to start a computer as a netsync client, launch "EP.EXE NETSYNC".

You may also use the "Netsync client" shortcut found in the "Eye and Pen 3" program group in the Windows Start menu.

There is no order for launching applications: if the client is launched before the master it will keep on trying to connect until either it succeeds or you stop it.

There is no check for dongle presence with a NetSync client.

You may therefore use as many Eye and Pen installations as the master host is able to accept (this number is defined by the master host dongle).

Acquisition	×
- Session	
Script	Connecting
Participant ID	192.168.10.100:50000
Group	
	Do not overwrite previous recording
	Go! Quit

Figure 51: NetSync client connecting.

After the client application has been launched, it will try to establish a connection with the server (master).

Once this connection has been established, if the *Stimuli* and *Scripts* folder update option has been selected (*File / Configuration / Edit* menu, *Network* tab, p. 49), the client will download any missing or very recent files.

This update feature may be used to distribute scripts and stimuli to client hosts without having to manually copy theses files to each host.

Next, the client sends a list of the scripts (\*.txt) contained in its *Scripts* folder to the server (defined in the *File / Configuration / Edit menu, Script tab, Scripts* folder option).

The client then waits for the server to send information about the session (session name, participant identifier) and the script to be executed.

Note:

The session name will be used to create a sub-folder in the client's data folder (as defined in the *File / Configuration / Edit* menu, *Script* tab, *Data Folder* option).

Once script execution has started on the client host, the latter may send a message to the master host notifying it that it is waiting for an authorization to continue (via the script command WaitForNetSync), or send a "common" information message to the master (via the command SendMessageToNetSync) whose content will be displayed in the "Status" column (see Fig. 52).

As soon as the client has finished its scripted acquisition process, it will automatically send an end message to the server.

The client then waits either for a "disconnect" message from the server, or else for an order to send a copy of its acquisition session data files (these files will remain in the client host's data folder).

Once the client has received the "end" message, it will start waiting for a new acquisition session.

<u>Note</u>: if a problem arises (faulty network connection, etc.), the "connecting to server" procedure can be aborted by pressing the Esc key on the client's keyboard or by clicking on the X in the upper right-hand corner of the dialog box. The software will immediately stop running.

# IV.3. Master

The master application (the server) is launched from the "*File / Acquisition / NetSync*" menu in Eye and Pen.

There is no order for launching applications: if the client is started up before the server it will keep on trying to connect until either the server (Master) accepts the connection or the application is closed.

Once it has been launched, the master application can accept any client at any time.

The server can accept a maximum of 25 clients. Please note that the efficiency of the network connections is governed by the master's performance and the quality of the network.

	Client name	Participant	Script	Status	Cm
All clients		Scri	ot	•	G
Consign	NoName			<b>v</b>	
26221011	Norvanie			▲	
kimum number	of clients: 5				
sion option: da	ata copy to C:\Users\o	chesnet\Documents\EP_De	v\data\		

#### Figure 52: NetSync interface.

When a client is connected, information is automatically added to the "dashboard" in a new line. This information is set out below:

LABEL	DESCRIPTION
IP	IP (network) address of the client host. This data is informative and cannot, therefore, be edited by the master host's application.
Client name	Client host's name on the network. This data is informative and cannot, therefore, be edited in the master host's dashboard.

Participant	To edit the p press the F2 <u>Caution</u> : the one of them participant's	participan key of the characters , a dialog name will	t's ide keyboa s '\"/ g box be use	ntifier, dou ard on the n ' : * ? < >   ' will inform ed to structu	ble-click on the dashboard cell or naster host. % are not allowed. If you try to use n you that it is not allowed (the ure filenames).
Script	Filename of t To select the "Script" scrol the client he establishing t	he script t script file ling list th ost's <i>Scri</i> he connec	to be ex mame, nat app <i>pts</i> fo etion).	xecuted on the click on the pears. This l lder (this	the client host. e cell and select the name from the ist contains all the scripts found in list is sent to the master when
	IP 10.16.66.6	Client name mshsdch	e gure 53.	Participant Sujet0 : Selecting a s	Script         V2_mental_load.txt         V2_cones_mask.txt         V2_copy_NetSync.txt         V2_loadlist.TXT         V2_color_mask.TXT         V2_color_mask.txt         V2_color_mask.txt         V2_color_mask.txt         V2_color_mask.txt         V2_fictation.txt         v2_fictation.txt
Status	Shows the messages).	status m	essage	returned	by the client host (predefined
	Label		Des	cription	
	Waiting for	session	The o	client is wai	ting for the session information.
	Session rec	eived	The o session	client ackno on informat	wledges that it has received the tion.
	Waiting for	Go	The or or or	client is wai er (click on t 1 the "Go" b	ting for an authorization from the he "Go" button at the end of the line utton in the "All clients" toolbar.
	Working		The o	client is exe	cuting its script.
	Job complet	ed	Scrip	t execution	is terminated.
	Copy starte	d	Data	copy from	the client has started.
	Copy compl	eted	Data	copy from	the client is over.
	Updating		The o	client is dow	vnloading scripts and stimuli.
	This column SendMessage	<b>a can als</b> ToNetSyr	so disj ne com	play messa mand.	ages sent by the client via the
Cmd	Contains a " stage. This b command.	Go" butto utton is e	on that enabled	t is disable l when the	d (shaded) during the connection client sends the WaitForNetSync

If a client breaks its connection, its line will remain in the dashboard, but its information will be erased (Participant, Script, Status).

A client can be deleted or added to the session that is currently running via a mouse right-

click on its line on the dashboard (contextual menu).

Below the dashboard you will find two toolbars.

All clients	Sc	eript 🗸 🗸 🗸	GO
Session	NoName	► = X	

Figure 54: NetSync toolbars.

The first toolbar allows you to manage the whole set of clients at once. The following table describes its components:

LABEL		DESCRIPTI	ON	
All clients	This list contain a script is selec "Script" field in	ns the script names that are cted from this list, it is assi the dashboard will be updat	common to all the clients. V gned to each of the clients ed with this name).	Vhen (the
	All clients	Script		-
	Session Maximum number of clier Session option: data cop	NoName nts: 25 ay to C:\Documents and Settings\chesnet\Me	V2_mental_load.txt V2_zones_mask.txt V2_copy_NetSync.txt V2_delayed_trace.txt V2_loadlist.TXT V2_color_mask.TXT V2_RecStd_newpics_with_maxdisplay.txt V2_dictation.txt	
		Figure 55: Selecting a script f	or all the clients.	
GO	Allows you to s meant to be us "Status" column This button is e	send a "start" signal to all t ed when clients have reques n of the dashboard displays t mabled as soon as the acquis	he client hosts. This messa sted permission to continue he "Waiting for Go" messag ition session has started.	ge is (the ge).

The second toolbar is dedicated to managing the acquisition session.

LABEL	DESCRIPTION
Session	Name you give to the session. The date, hour and seconds will automatically be added to the name.
► Start session	When you click on this button, it triggers the sending of information required by each client to start an acquisition (session "name" field content, current time and date, "Participant" and "Script" names for the client).
	The application checks that a script has been selected for each client. If not, a dialog box lists those clients who do not meet this condition and stops the process, allowing the situation to be rectified.
	As soon as the session has started, the "Session end" button is enabled.
	and Pen 2\data
End session	This button allows you to trigger the ending of the acquisition session, for example copying data from the client to the server (if this option has been selected in the <i>File / Configuration / Edit menu NetSync network</i> tab. / <i>NetSunc Master Options</i> ). Once these operations have

	been completed, the "Session start" button is enabled again, allowing you to start a new acquisition session with another script, for example.
Close clients	This button allows you to disconnect all NetSync clients. Each client application will therefore be shut down after disconnection).

The panel at the bottom of the NetSync dashboard is used to display messages relating to the server's work (transfer option, data transmission, etc.). When data are uploaded by clients, the name of each copied file is displayed in this panel.

#### Log file

On the Master host, the parameters of each acquisition session are written in the file named "NetSessions.log" (in the Eye and Pen *Data* folder).

If the client data copy has been selected (see NetSync configuration, p. 49), the session-specific data will be recorded in a file named *<SessionName>*.log, in the folder containing the acquisition data.

#### A few recommendations

- ✓ Client host identification is based on clients' IP addresses. In Windows Vista/7, the "Network Discovery" service must be enabled for this mechanism to succeed<sup>3</sup>.
- ✓ Network communication may be blocked by the Windows Firewall, so make sure that you have disabled it for the duration of the acquisition.
- ✓ When managing an acquisition with NetSync, everything that can use up resources (and, above all, everything that can use up network resources), is a potential hindrance to data acquisition. We strongly advise you to "clean" acquisition computers, removing software such as Messenger, AIM, NetMeeting, Chat, Skype, etc.
- ✓ For the duration of data acquisition, disable antiviruses, connections and network services not required by the experiment (Bluetooth, etc.).
- ✓ Disable everything you can, including all the "Quick Start" programs of software such as Adobe Reader, LibreOffice and Microsoft Office, together with the automatic updates.

A safe and simple method is to set up your own private network that is not connected to the Internet. In the Appendix (p. 170), you will find an example of a WiFi private network we used in a classroom.

<sup>&</sup>lt;sup>3</sup> <u>http://www.thewindowsclub.com/enable-disable-network-discovery-windows</u>

#### V. RETROSPECTIVE COMMENTS

(Display / Retrospective menu to show/hide the tool)

This tool is a sort of Dictaphone whose recordings are kept in synchrony with the protocol analysis. It can be regarded as an acquisition tool (e.g. you can ask the participant to comment on his or her own production afterwards, or about that of someone else), but also as a tool to help analysis (e.g. making vocal annotations about the coding of a protocol).

To be able to use it, you must own an audio recording device (e.g. a microphone) and playing device (e.g. speakers or headphones).

A *retrospective comment* is made up of an audio recording, a start timestamp and a name. The *"Retrospective"* tool allows you to:

- record/listen to a recording;
- directly "jump" to the start time (insertion point) of a recording in the protocol.



Figure 56: Toolbar for recording retrospective comments

The recording is saved in an audio Wave file format (.WAV) and is "linked" to the current tablet data timestamp (in the protocol) for the start of the comment recording.

For example, if a recording was started at timestamp 2,154 milliseconds in the protocol ACI\_108 (the timestamp can be seen in the "clock" tool), a field named ACI\_108.00002145.wav will be created in the data folder.

The list of retrospective comments is saved in a (*<participant*>.RTR) file when the analysis is saved.

The following table explains the function of the tools in the toolbar:

ICON	DESCRIPTION
	Record. Selects the current protocol timestamp (time elapsed since the start of data acquisition as displayed by the "clock" tool) as a link for the recording and starts the audio recording. If the current timestamp of the protocol is that of a previous audio recording a dialog box will warn you about it and prompt for overwriting.
•	Listen to the selected comment.
0	<b>Stop</b> . This button is red while listening to or recording a comment. If you stop a recording, a dialog box will prompt for a descriptor (a "name" or label).

	<b>Figure 57:</b> Descriptor <b>Figure 57:</b> Descriptor <b>Cancel Cancel Cancel Concel Cancel Concel Cancel Concel Concel</b>
2	Edit. To change a comment's descriptor (its "name"), select this comment (see button ▼, below) then click on the  button. The comment's descriptor dialog box will appear. <b>Fetrospective comment Figure 58:</b> Modifying a comment's label. Modify the comment's name (the dialog box can be resized) or click on the button allows to select a descriptor in a template (see further for details). Click on the "OK" button to validate.
Ŭ	<b>Delete.</b> To delete a comment, select its descriptor (see button , below), then click on the trashcan icon. When a "retrospective comments" list entry is deleted, the associated Wave file is sent to the Windows recycle bin.
×	Select. When you click on this icon, a list scrolls down and displays the existing comments' labels.Click on the comment label of your choice to jump to the start of the selected comment.Important: comment labels are listed in order of creation, starting from the top.

# Template

The template is hierarchically organised list of descriptors. This list may be modified, saved as default file or under a new name.

€ <sub>P</sub> Sequence descriptors template
a first sub-level (2) item     a second level 2 item     a a third level 3 item     a nother level 3 item     a third level 1 item     another level 1 item     another level 1 item {with a remark from me to coder}
Expand all

Figure 59: Template (hierarchically organized).

The template can be used in two modes :

- 1. an « editor » mode : the person who creates/modifies the template (maybe distribute its template to « coders » working on a bunch of protocols).
- 2. a user mode : a person who select an item in the template, as a descriptor.

Content and organization of template is totally free. This means that one can add a first level item as a root for a syntax description tree, then another first level item as a root for orthography descriptor, and so on.

To edit the template, just right click on an item.

New sub-item Edit Delete Suppr	New sub-item			
Edit Delete Suppr	- 10x			
Delete Suppr	Edit			
	Delete	Suppr		
		Delete	Delete Suppr	Delete Suppr

Figure 60: Template edition functions.

A sub-menu shows up, that allows to :

- 3. Add a new item (at the same level)
- 4. Add a new item in a sub-level of the selected item
- 5. Edit the selected item
- 6. Delete the selected item.

Edit opens a dialog box I which you may change the item text, but also add a comment, that will be displayed between brackets (for example, information on how to use this item, or who should use it).

Sequence descriptors template	
Descriptor text	
a new item	
Comment (optional)	
to test	
	Ok Cancel

Figure 61: Modifying a template item.

ICON	DESCRIPTION
Insert	Inserts the selected item into the descriptor. It does close the editor. More than one item can be selected and inserted (one at a time) into the descriptor field.
Close	Closes the template editor.
2	<b>"Open"</b> : Loads a template file. A dialog box allows to selected a template XML file to be loaded into the editor. For example, it allows to use a template created by a colleague.
	<b>"Save as"</b> : allows to save the template in a file that is not the default template file. A dialog box allows to give a new name. For example, this allows to export one's template to give it to colleagues.
	<b>"Save"</b> : save the current template editor content into the default template file.

Template files are saved by default in the Models folder (see *File/Configuration/Edit* menu, *Script* tab to select the Models folder).

The default template file for retrospective comments descriptors is named retroSeqDescList.xml.

The default template file for sequences descriptors is named SeqDescList.xml.

The default template file for audio sequences descriptors is named AudioSeqDescList.xml.

# CHAPTER 3: data analysis

#### I. INTRODUCTION

Data analysis allows you to sort, code and export recorded data (into text files).

In Eye and Pen, data analysis is based on the principle of the VCR: things are viewed as though the participant were being "filmed" during production. You can then watch the resulting movie in a variety of ways. To do this, different tools allow you to "navigate" through the data, moving forward or backwards with self-defined filtering parameters.

As soon as you launch the Simple or scripted acquisition mode, tablet and eye tracking data (if selected) are recorded and "stamped" with a common time baseline (in milliseconds).

To make data geometrically compatible, the coordinates of the eye tracking data are converted into the same coordinates system as the tablet data. The tablet is used as a reference.

#### **Example**

If the tablet coordinates are in a (0, 0, 30240, 30240) frame and the "eye" coordinates are in a (0, 0, 1024, 768) frame, the "eye" coordinates are scaled to the (0, 0, 30240, 30240) frame so that both sets of information can be stacked on the same surface.

#### Important:

If the sheet of paper slips on the tablet, or the eye tracker helmet moves on the participant's head, eye-tracking and tablet data will not be spatially accurate. Thus, **some eye tracking data may be outside the calibrated area instead of inside, where it should be**. To help solve this kind of problem, "Eye and Pen" has a tool that can "shift" an entire set of data (see page 118).

# 🥊 Hint:

To avoid pointless extra work, we recommend that you initially apply every **overall filter** in order to reduce the total amount of data (shift layers, fixation building, out-of-field data cleaning etc.). Next, apply the **automatic coding filters** (Areas Of Interest, etc.) and only then begin the **qualitative and manual analyses** (coding, etc.).

Here is an example of what should be avoided: you have coded some pauses "by hand" and you then apply an automatic coding. The codes of these pauses may change, even if you do not want this to happen.

It is important to carry out these operations in the right order.

The analysis may be closed at any time, by clicking on the "*File*" menu, then selecting "*Close*" (keyboard shortcut is ALT + F4).

# II. START AN ANALYSIS

When analysing data for the first time, you may want to configure the data analysis, see "Data analysis configuration" in <u>chapter 1</u>.

To start a data analysis, you can:

- **Start a new analysis:** click on the "*File*" menu, then select "*Open*". A dialog box will be displayed so that you can select the tablet data file (file with a ".tab" extension) you want to analyze. Click on the "*Open*" button;
- **Reload a previous analysis:** click on the "*File*" menu, then select "*Open*" and "*Open*". A dialog box will let you select the analysis data file (file with a ".twk" extension) you want to work on again. Click on the "*Open*" button;
- **Re-open an acquisition session:** click on the "*File*" menu, and then select the "*Session*" sub-menu. A dialog box shows up. Then, one can select the session "log" file (the file name extension is « .LOG ») that you intend to explore. Next, click on the "Open" button;

# III. RECORDING SESSION (LOG)

For each "Script" acquisition session, a file named (*<Data Dir.><Participant Id.>.LOG*) is created, incorporating all the main interactive events involving the participant (displays, recordings, participant's responses, etc.), with their corresponding times (milliseconds). Timing starts at the very beginning of the acquisition session (time zero).

This information is shown as a tree view and sorted by time (the oldest event at the top). In the following example, the script was loaded at 10 milliseconds, a picture was displayed at 45 milliseconds, etc. (for code meanings, see p. 172).



Figure 62: Acquisition session.

# Hint:

An option in the configuration panel (see menu *File/Configuration/Edit* menu, *Application* tab) allows to select the level of information presented: full log or recordings only (see example below). In this "mode", the panel only displays the file name (the full path is displayed into a floating hint) and downsizes itself to the minimum width required.



Figure 63: Session log, showing recordings only.

The icon showing "a hand writing on a tablet" stands for data recorded with RecStandard (Simple recording), the icon showing a camera stands for recording performed with the OpenRec script command. Just click on the icon to open it in Eye and Pen

One may also see a text icon, which stands for script file or other type or text file. Clicking on it will re-open the file in the script editor.

# About events and timestamps...

The time indicated is the event start time. For example, when a picture is displayed, the timestamp is the very point at which the display procedure started, not the time when the picture became fully visible to the participant.

Elements tagged "File" can be clicked on and then either opened in a Windows application or else in Eye and Pen, if it is a picture or a protocol recorded using the RecStandard command.



Figure 64: A "RecStandard" recording session log.

When opening a RecStandard via the "Session" menu (click on the floppy icon), the associated parameters recorded in the log file are loaded (background, pictures 1 and 2, and end zone). During a RecStandard recording, unexpected events are also recorded (e.g. a keyboard keypress or the end of a sound) and are treated as sub-events of RecStandard.

The session log indicates the true display coordinates of pictures and videos. For example, if the script includes the command DisplayPic(toto.bmp, 2000, -1, -1), i.e. display "toto.bmp" for 2,000 milliseconds centered in the display window, the log file will show the exact coordinates of the upper left-hand corner of the picture in the display.

In general, the floppy icon stands for Eye and Pen recordings. Clicking on the file name reopens it in Eye and Pen. If an analysis already exists for this file, then the analysis will be opened, over the acquisition file.

The folder icon stands for file that will be opened with their associated application in the Windows system. For example, audio files may be opened with Windows Media Player.

A mouse right click on the tree allows to select its behavior:



The log file is a "text-only" file type, so you can load it in various other types of software (text editor, word processor, spreadsheet, databases, etc.).

#### IV. INFORMATION AVAILABLE AT ANY TIME

In "analysis" mode, the screen is composed of a number of elements bar:

- 7 navigation tools:  $\succ$  from event to event;
  - from pause to pause;
    - from fixation to fixation;
    - ➢ by tablet data code;
    - $\triangleright$  by eye data code;
    - with the distance between pen and gaze locations;
  - > a stopwatch (clock);
- a tool for creating sequences in the protocol;
- a tool to record the retrospective verbalisations;
- a zoom;
- a key press recorder;
- a tool for coding data;
- an information bar (status bar); You may click on the icon next to the background file name to change it.



Figure 65: Data analysis screen.

If the protocol includes an audio recording, then an audio sequences toolbar is show.

These tools can be shown or hidden via the "Display" menu (except the audio data toolbar that is shown only if the protocol includes audio recording).



Figure 66: Menu to display tools.

Pause representation



Figure 67: Representation of a pause.

When the pen is "Up" (pauses build), a circle indicates the point where the pen left the tablet and a line connects this circle to the place where the pen subsequently "lands" (see *File/Configuration/Edit* menu, "*Analysis*" tab to select "pause color").



**IV.1.** A tool for coding

Figure 68: The coding tool.

While navigating through the protocol, the coding tool will show details of the current tablet and eye-tracking data. The code is a digit value (it is up to you to give it meaning) from -1 ("ignore this sample") to 1024.

LABEL	DESCRIPTION
Ρ	Pressure exerted with the pen on the tablet.
	When the gaze position is beyond the calibrated area, a warning signal is displayed to the right of the pen pressure field, in the "Eye" data column.
x	Coordinate of the data (tablet or eye) on the horizontal axis.
Y	Coordinate of the data (tablet or eye) on the vertical axis.
D	Duration (in milliseconds) of the event, defined as the time that elapses between the current data and the following data of the same type (tablet or eye).
Ν	Data number (numbering from zero upwards). Each type of data is numbered separately.

You can reduce or enlarge the tool by double-clicking on its title bar. You can also move it or resize it dragging the border of the panel.

# IV.2. Information bar (status bar)

(Display/Information menu to show/hide this tool)

This tool provides additional information about the current data.

X 5027 Y 5031	d(E) 3681,98	v(E) 526,00	d(T) 3887,28	v(T) 3887,28	d(TE) 0,00	d(nP)	👌 no background picture	[17479 msec][2563 tab][63 eye]
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

Figure 69: the information bar.

This information is described from left to right.

LÆ	BEL	DESCRIPTION
(1)	X Y	Mouse cursor's horizontal and vertical coordinates, expressed in tablet units. It may help you to check for the coordinates of a particular place in the protocol.
(2)	d(E)	Euclidian distance between current eye data (E stands for Eye) and the position of following eye data (in tablet units).
(3)	v(E)	Speed of movement between current eye data position and following eye position (in tablet units per millisecond).
(4)	d(T)	Euclidian distance between current eye data (T stands for Tablet) and the

	position of the following eye data (in tablet units).
<sup>(5)</sup> v(T)	Speed of movement between current pen (Tab) data position and following pen position (in tablet units per millisecond)
<sup>(6)</sup> d(TE)	Euclidian distance between current tablet data position and current eye data position (in tablet units).
<sup>(7)</sup> d(nP)	Tracing distance (pen movements) between the end of the last "up" pause and the following "up" pause (in tablet units). This information can help you anticipate the next pause.
<sup>(8)</sup> C:\	Path and name of the background picture. Click on the icon to select a new one.
<sup>(9)</sup> [msec] [tab] [eye]	[ Total duration of protocol (in milliseconds) ] [ Total amount of tablet data ("tab.") ] [ Total amount of eye-tracking data ("oc.") ]

# IV.3. History

(Protocol/History menu)



Figure 70: History dialog box listing actions.

This menu displays the list of processes that have been applied to the protocol in order to reduce the total amount of data, such as building fixations or the aggregation of successive data with the same code.

When an action is canceled, the corresponding entry is removed from this list.

#### V. **NAVIGATION**

#### Introduction V.1.

You can navigate through the data in two ways:

"spatially", by clicking with the right mouse button first on the place in the protocol that you would like to jump to (participant's writing on the tablet), then on the "Jump here" contextual menu that appears (see below).

Leane la cale w trada con a 1 Interiora

Figure 71: "Spatial" navigation.

Eve and Pen searches for the nearest item of data in a 5-pixel square around the mouse cursor position. When it has been found, the protocol is "played" until it reaches this item.

- searching for a particular category of event:
  - from one item of data to the next; 0
  - from one pause to the next; 0
  - from one fixation to the next: 0
  - searching for the next item of "eye" or "pen" data with a particular code value; 0
  - searching for the next point where the distance between "eye" and "pen" data 0 meets a given criterion.

The "Display" menu allows you to show or hide the navigation toolbars located under the menu.

These tools can be moved using "drag'n'drop":

STEP	DESCRIPTION
1	Click with the left mouse button on the vertical "line" left of the toolbar (to the left of its label)
2	Keep the left mouse button pressed down
3	Move the toolbar to the desired location.
4	Release the mouse button.

# **Important:**

- > the "shift + T" shortcut re-centers the protocol to make the pen cursor visible, i.e. on the screen :
- the "shift + E" shortcut re-centers the protocol to make the eye cursor visible,  $\geq$ i.e. on the screen.

#### V.2. Navigating from one event to another

(Display/Toolbars/Events menu allows you to show/hide this tool)

This tool allows you to navigate within the protocol, from one event to another, through the whole set of data (tablet and eye-tracking). An event is either a movement or an immobilization of the pen or eye. An item of data is understood to be the content of an event: its coordinates, its timestamp, etc.



Figure 72: Navigating from one event to another.

ICON	DESCRIPTION
ч	Jump to the beginning of the protocol.
•	Previous event.
*	Move continuously back through the events (does not respect events duration).
۲	Move continuously forward through the events, respecting events duration. Replay speed can be changed (see options).
₩	Move continuously forward through the events (does not respect events duration).
	Next event.
м	Jump to the end of the protocol.
	Replay options. A menu allows you to set replay speed (from 0,1 to 4 times the normal speed).
	Replay speed Animation speed Animation speed 0.1x 0.2x 0.5x 1.0x 1.5x 2.0x 2.5x 3.0x
	Figure 73: Set the protocol replay speed.
	Protocol replay may be animated, during pauses. A circle (centered at pause beginning location) will grow as time goes by. Its growth speed may be selected amongst four values ranging from "slow" to "very fast".



# V.3. Navigating from one pause to another

(Display/Toolbars/Pauses menu to show/hide this tool)

This tool helps you to navigate from one pause to another, for a greater duration than the defined threshold (see <u>Thresholds</u>). Its icon comprises a hand holding a pen and the pause symbol used in audio/video players (a vertical double bar).

This tool features fast-forward and rewind functions, either per number of pauses or per pause duration (greater or equal to a defined value).



Figure 76: Navigating through pauses.

ICON	DESCRIPTION
-	Previous pause (up or down).
•	Next pause (up or down).
_^	Go to the end of the current pause.
*	Step back by " $n$ " pauses (up or down) or jump to the previous pause whose duration is longer than the given value.
100 🜲	Number of pauses (or duration) for the "backward/forward by $n$ pauses" function.
	A mouse right-click opens a contextual menu allowing you to choose what the content of this field stands for: number or duration.

	50 Number of pauses • Pause duration
	Figure 77: Choose navigation criterion (duration or number of pauses).
	<b>Hint</b> : when the mouse hovers above the "value" field, a tooltip shows up to indicate the current meaning of the value:
	2000 Pause duration
	For pause duration, the smallest value is the smaller of the two sorts of pauses: up or down.
**	Step forward by " $n$ " pauses (up or down) or go to the next pause whose duration is longer than the given value.
	<b>Hint</b> : when the mouse hovers the "value" field, a tooltip shows up to indicate what is the current meaning of the value:
	50 Next pause lasting 50 milliseconds or longer

# V.4. Navigating from one fixation to another

(Display/Toolbars/Fixations menu to show/hide this tool)

This tool helps you to navigate from one fixation to another, with a greater duration than the defined threshold (see <u>Thresholds</u>). Its icon comprises an eye and the pause symbol in audio/video players (a vertical double bar).

This tool features fast-forward and rewind functions, either per number of fixations or per fixations durations (greater or equal to a defined value).



Figure 78: Navigating through fixations.

ICON	DESCRIPTION
-	Previous fixation.
•	Next fixation.
_^^	Go to the end of the current fixation.
*	Step back by " <i>n</i> " fixations or jump to the previous fixation whose duration is longer than the given value.



# V.5. Navigating through "Eye" data filtered by code

(Display/Tolbras/Eye codes menu to show/hide this tool)

This tool helps you to navigate through the eye tracking data ("Eye"), filtered by a code you have selected (see <u>Data coding</u>). This enables you to jump from one item of Eye data with the required code to another. Its icon comprises an eye with a sharp symbol (i.e. numbering) on top of it.



Figure 80: Navigating with Eye data codes.

ICON	DESCRIPTION
≠∢	Go back to the previous "Eye" data item without the required code value.
=4	Go to the previous Tab data item with the required code.
2	Code value.
▶=	Go to the next "Eye" data item with the required code.
►≠	Go to the next "Eye" data item without the required code value.

# V.6. Navigating through "Tab" data filtered by code

(Display/Toolbars/Tab codes menu to show/hide this tool)

This tool helps you to navigate through the tablet data ("Tab"), filtered by a code you have selected (see <u>Data coding</u>). This means that you can jump from one item of tablet data showing the required code to another. Its icon comprises a hand with a sharp symbol (i.e. numbering) on top of it.



Figure 81: Navigating with tablet data codes.

ICON	DESCRIPTION
≠∢	Go back to the previous "Tab" data item without the required code value.
=	Go to the previous "Tab" data item with the required code.
110 🜻	Code value.
▶=	Go to the next "Tab" data item with the required code.
►≠	Go to the next "Tab" data item without the required code value.

# V.7. Navigating through data filtered by gaze-pen distance

(Display/Toolbars/Eye-Tab distance menu to show/hide this tool)

This tool allows you to navigate through the data on the basis of the (Euclidian) distance between the simultaneous gaze and pen positions (in tablet units).



Figure 82: Navigating according to the distance between gaze and pen positions.

ICON	DESCRIPTION
<b>*</b> •	Jump back to the previous point where the distance was below the criterion.
*•	Go back to the previous point (time) where the distance was equal to or above the criterion.
2000 🕏	Distance criterion (in tablet units).
► <b>∛</b>	Go to the next point where the distance was equal to or above the criterion.
▶<	Jump to the next point where the distance was below the criterion.

# V.8. Navigating through time with the "clock"

(Display/Toolbars/Clock menu to show/hide this tool)

As soon as data recording starts, each item of data is "time-stamped" with millisecond timing. Time "o" (zero) is the point where the recording started.

This tool allows you to navigate through the data, according to the time.



Figure 83: The clock.

The time (in milliseconds) that has elapsed since the beginning of the recording is displayed to the right of the "clock" icon. When you click on the icon, the dialog box below appears:



Figure 84: Dialog box for selecting a particular "time" in the protocol.

There are two ways of reaching a particular point in the data:

- key in (or select with the up/down arrow) the desired timing in the box;
- slide the cursor to select the time you want.

# V.9. Navigating through audio recording

When the protocol includes an audio recording, the audio wave is displayed. You may also click on the wave to set protocol to this time. Wave and Tab/Eye data visualisation is synchronized.

	and a fill and a second s
r	
rendre visite à Mêre aravid en pa	nouge Un jour, il dec asunt pour le faret. C'

Figure 85: Audio is synchronized with Tab samples.

A toolbar helps to "navigate" in the audio file. The left side of the toolbar is devoted to sequences description and is explained further in this manual.

•	Image: Interpretation in the second seco	0	1357	blank before speech	• 2/	<b>4</b>   <b>b</b> = b	< 1

Figure 86: Audio toolbar display.

ICON	DESCRIPTION
•	Play wave. When playing is started, this button is replaced with a pause button
	Stop playing.
₩	Fit all wave in screen
<b>~</b>	Zoom out
<b>~</b> *	Zoom in
1:1	No zoom

The toolbar has buttons (on its left side) dedicated to playback and display.

#### VI. THRESHOLDS

#### (Protocol/Thresholds menu)

Thresholds are used as filters. They are involved in navigation and calculations, including data outputs and previews.

Thresholds	
Thresholds (in milliseconds)	
Pen "Up" pause	15
Pen "Down" pause	50
Eye fixation	10
Apply thresholds to code r	navigation
_	
	OK Cancel

Figure 87: Threshold dialog box.

LABEL	DESCRIPTION
Pen "Up" pause	A pen event lasting longer than this value (with zero pressure) is considered to be a pause.
Pen "Down" pause	A pen event lasting longer than this value (with a pressure above zero) is considered to be a pause.
Eye fixation	An eye event lasting longer than this value is considered to be a fixation.
Apply thresholds to code navigation	If this option is ticked, the above thresholds will be applied as a secondary filter when using the " <i>By Tab code</i> " and " <i>By Eye code</i> " navigation tools (see page 95), i.e. an item of data must meet a double criterion (code + duration) if it is to be selected.

Minimum threshold values

For events only defined by their duration (down pauses or fixations), the minimum value of their threshold is the duration of two samples. Considering shorter durations may lead to accept each sample as a possible fixation or pause.

Expressed in milliseconds, the minimum value for thresholds is determined by the formula  $2^{*}(1,000/\text{Sampling rate})$ . For example, with a 200Hz sampling tablet, i.e. sampling 200 pen positions per second (=1,000 milliseconds), the minimum threshold will be:  $2^{*}(1,000/200)=10$  milliseconds.

As the "loss" of one or two consecutive data samples may occur during the acquisition or transmission of the data to the program, we strongly suggest a minimum value equal to the duration of 3 samples.

**Hint**: to view/edit all pauses (or fixations), set the minimum corresponding threshold.

#### VII. ALTERING SAMPLES

Eye an dPen has a number of feature that alter data, some related to signal processing, some related to data clustering.

Although selection of methods and options can be found in the *File/Configuration/Edit* menu (*Tools* tab), their principles of action are described here, in the Analysis section of the manual, because they are applied on protocol via the *Tools* menu.

Please remember that original acquisition data are never modified, only their copies within the analysis data may be altered.

#### VII.1. Changing the sampling rate

(Tools/Resample menu)

The main usage of this tools is to "align" Tab and Eye data using the same sampling rate. Since resampling sometimes means calculating samples between two existing samples, a linear interpolation between coordinates is applied (x and y are processed separately). As a rule of thumb, this "low level" transformation should preferably be performed first, before any other transformation (such as building fixations, pauses, coding, etc.).

Note:

If fixations already exists, samples falling within these fixations will take the fixation coordinates.

Resample						X
Parameters						
Sampling rate (Hz)		100	•			
🔲 Compress samp	ples into pause Up					
Output file	C:\Users\chesnet\[	Desktop\S	ujet5_Chap	peron_PAGE0	_100Hz	2
				Ok		ancel

Figure 88: Resampling dialog box.

LABEL	DESCRIPTION						
Sampling rate (Hz)	Allows to set the desired new sampling rate, in Hz. A scroll down list proposes commonly found sampling rate. You can also type in the desired sampling rate.						
Compress samples into pause Up	Compressing samples into Up pauses means that successive Tab samples with a pressure level below 1 (zero or less) will be summed up as one sample.						
Output file	Creates two new files: ".TWK" and ".EWK". By default, the proposed output file name will end with the selected sampling rate value, as in the following example:						
	Output file C:\Users\chesnet\Desktop\Sujet5_Chaperon_PAGE0_200Hz						
	Please note that it does not export new data created in analysis such as sequences, word separation, etc. This gives just a new protocol analysis basic files.						

Clicking the "**Ok**" button launches resampling and files creation. A dialog box acknowledge the process (if the option has been selected in the *File/Configuration/Edit* menu, *Application* Tab).



Figure 89: End of resampling processing dialog box.

#### VII.2. Building eye fixations

#### (Tools/Build fixations menu)

Eye fixations are a construction and do not "naturally" exist: the eye gaze never stands still. Building a fixation basically consists in grouping data as though they represented the same event (the eye remaining at a given location for a certain amount of time). Many methods exists to calculate fixations, each one has its drawbacks and arouses controversy (cf. <u>Bibliography</u>).

**Caution**: take care not to build more than one fixation at a time in the same protocol, as this method is data destructive. Once a fixation is determined, all the samples within it are replaced by the fixation centroid. A "second go" may have the effect of clustering fixations whose centers have moved closer to each other. When in doubt, consult the history (*Protocol/History* menu)

Note: fixation thresholds (see Thresholds, p. 98) allow you to filter fixations according to

their duration. Fixations below this threshold will not be taken into account for navigating or editing.

To build fixations, simply click on the "*Tools*" menu and select "*Build fixations*". That's all.

Method used to build fixation is selected in the *File/Configuration/Edit* menu, *Tools* tab, and are explained and discussed in the following paragraphs.

# VII.2.1. Barycenter method

#### Method:

An initial item of data is regarded as a cluster beginning and center. Each subsequent sample is compared with this cluster and integrated (cluster centroid value is updated) if its distance from the cluster center is below a defined threshold (known as the deviation threshold).

<u>Note</u>: the greater the amount of data included in the cluster, the "heavier" it becomes and the less likely its centroid is to "move" with the addition of new samples.

If the cluster represents a duration greater than the "minimum duration to start a fixation", it is deemed to represent the start of a fixation.

A tolerance criterion allows you to accept samples above the deviation threshold, providing the following samples are below it (external samples are then integrated into the cluster).

Example:



Figure 90: Steps for building a fixation.

With a deviation threshold of 250 (tablet units), a minimum duration of 8 milliseconds and a noise tolerance of 4 milliseconds, we can state that:

- at Time 1, no fixation exists: data duration in the "diameter" threshold duration is below 8 milliseconds;
- at Time 2, with new data, the start of a fixation is "detected";
- at Time 3: the fixation "grows" with the addition of two more items of data, including one external item because the following item is located within the "packet" in less than 4 milliseconds.



*Figure 91: Building fixations parameters settings, using the "barycentric" method.* 

Fixation building is modulated by three parameters:

- minimum duration for starting a new fixation (in milliseconds);
- deviation threshold (in tablet units) : radius around the center of the fixation;
- Noise tolerance: number of samples "above" the deviation threshold that can be admitted as "members" of the current fixation if subsequent samples fit inside the cluster.

#### How do I define a deviation threshold? A practical example.

I recorded a participant's writing on an LCD tablet (Wacom Cintiq18SX) and eye movements with an S.R. Research Eyelink2 eye tracker.

I wanted my deviation threshold to be at a viewing angle of 2°.

To be able to calculate what this angle represents on the tablet's screen, I needed some physical measurements. Thus, I measured the distance between the participant's eye and the center of the tablet screen (30.4 cm), then the display width (only the "active display part", not the whole screen "box"): 33.5 cm.

The remaining information can be found in the *Protocol* | *Description* menu, under the *Specifications* tab.

It says that the eye tracker has ranges of 1024\*768, the tablet has ranges of 7220\*5784 (resolution is 200 lines/cm) and its display has ranges of 1024\*768.

When these data are fed into the ? | *Conversions* | *angle* -> *Pixel* tool, it tells us that 2 degrees correspond to 34 pixels. But how many tablet lines do 34 pixels represent ?

I wrote 34 in the bottom right-hand box ("pixels" column) in the ? | *Conversions* | *tablet units* <-> *pixels* menu and clicked on the "<-" button and up came the result: 240 lines.

# VII.2.2. Multi-threshold method

This method relies on the same general principles as the "Barycenter" method, but is more "conservative": it uses a double threshold principle that allows you to integrate a few "out-of-fixation" samples into the calculations.

#### Method:

To begin a fixation clustering process, there must be more than n samples (expressed as a duration in the "*Minimum duration to start a fixation*" field) in an area determined by sample dispersion (deviation) around the barycenter ("*Max initial Standard Deviation threshold*").

Ep Build fixations (multi-threshold)		
Fixations calculation Minimum duration to start a fixation (in milliseconds)	8	
Max initial Standard Deviation threshold (in tablet lines)	274	
Max distance between fixation and point (in tablet lines)	274	
Maximum tolerance distance (in tablet lines)	274	۲
Maximum tolerance duration (in milliseconds)	4	
ОК		Cancel

Figure 92: Building fixations parameters settings, using the "multi-threshold" method.

The distance of the following samples from the fixation barycenter is computed to see whether they should be included in the fixation's final calculation or not.

A tolerance criterion ("Maximum tolerance distance") allows you to accept samples whose distance is below this criterion but above the threshold ("Maximum distance between fixation and point") if the gaze position returns to the "acceptable distance" zone within a predetermined length of time ("Maximum tolerance duration"). If it does not, the fixation is ended. The barycenter of the "out-of-zone" group of samples is then computed. If the distance between the latter and the fixation barycenter is below criterion 2 (maximum tolerance distance), these samples are included in the final computation.

Finally, the barycenter of the fixation is calculated.

# VII.2.3. Speed threshold method

This method relies on a simplistic assumption: when eye position is nearly stationary, its mouvement speed tends toward a very low value, near to zero.



Figure 93: Building fixations parameters settings, using the "Speed" method.

Aggregate successive eye data with speed below	Aggregates successive eye data below a certain speed threshold.
(lines/ms)	This threshold must be empirically determined. It is expressed in lines (tablet counting unit) per millisecond.
	All successive moves (samples) with a speed below this threshold will be clustered into a single point.

This first "speed-based" approach may deserve future refinement, but already offers an alternative to geostatic methods.

Be aware that some eye mouvements patterns seems to be specific to handwriting/drawing: a

slowly moving trajectory. Setting a speed threshold too high may aggregate samples that are not to be considered as static, but involved in a slow motion. Thus, it is advisable to perform some tests to visualise the result.

#### VII.3. Filtering tablet data

(Tools/Filter Tab data menu)

Data filtering is a signal processing feature (more or less "data smoothing"), implemented in Eye and Pen as a Butterworth filter (a low pass filter).

To be able to set the filter parameters and test their effects, a protocol must be opened. Then open the *File / Configuration / Edit* menu, *Tools* Tab, and click on the *parameters* button of *Tab data Filter*.

(	€p Butterworth filter
★ Il éteit un fois, le petit chapero rendre visite à Mière arand en pa alors qu'il renuentre le grand m large avait déjè vu le petit chaper Alors il décide d'alter chaper Alors il décide d'alter en prenant s le petit chaperon vage ne té derteit mais personne ne lui ourvit. Alors surprise quelqu'en dans le lit à l le petit chaperon vouge se pose als longuos des grandes dents 7 De si gra ces poils ?! Haus le grand mêchant d'atraper le petit chapern rouge a à toute vitere. Hais par chane, moment le pour le shire thir et ai chapera vouge.	54000 × II itait ve fois, le petit chaperon roge. Un jur, il dicide - Filtered 50000 render visite à Mère. Camera en passant par le foret. c'est 50000 alors qu'il renvontre le grand michant loup. le grand michant 40000 Hone avait dijè vu le petit chaperne rouze et valait le capturer. 40000 Hone il dir 40000 40000 40000 40000 40000 30
	10 000 15 000 20 000 25 000 30 000 35 000 40 000 45 000 50 000 55 000
	Zoom 🕂 🔊
	Signal sampling rate (Hz) 200 🚡 Filter order 4 🚡 Cut off frequency (Hz) 10 🚡 Test filter
	Select cancel

Figure 94: setting parameters of the Butterworth filter.

A closer view at the filter effect on a single word is more illustrative. The original (unfiltered, in blue) signal shows "stairs", due to a poor spatial resolution of digitizer.



Figure 95: Butterworth filter settings.

The graph part of the panel shows the original signal (blue) and the filtered signal (red), superimposed.

LABEL	DESCRIPTION		
Limit graph to 10,000 sample	This option allows to limit the memory and calculations time involved by the filter setup and tests.		
View frequency spectrum	This button allows to visualise the frequencies distribution of the signal, original and filtered (see figure below).		
Signal sampling rate	This is the filter sampling rate. Normally, this should be the same as the protocol sampling rate. If it is not, a warning will be issued, giving choice to keep or replace the value:		
	Warning		
	Sampling rate set for filter (140 Hz) is different of protocol's sampling rate (200 Hz). replace filter's value ?		
	Yes No		

Filter order	The order of the filter represents the sharpness of the filter. It gives the number of coefficients of its polynomial calculation. The higher the order, the smoother is the output. Be aware that smoothing too much may create artefacts. For adults writers, a $3^{rd}$ or $4^{th}$ order is appropriate.
Cut off frequency	This represent the higher limit of frequencies that will be kept. This value can not be higher than half of the sampling rate.
Test filter	Click this button to apply the filter parameters to sample shown in the panel.



Figure 96: Frequency spectrum.

The combinaison of filter order and cut off frequency effects on an adult handwriting is illustrated below:



Figure 97a: 4th order, 15 Hz cut off.



Figure 97b: 4th order filter, 10 Hz cut off.



Figure 97c: 6th order, 10 Hz cut off (artefacts appears).

Unfortunately, many of the papers published using a Butterworth filter do not explain how they choose the order and cut off frequency of their filter. Nevertheless, some reference values can be found in papers such as Teulings & Mars (1984), which shows that main components of handwriting lies in the O-10Hz frequency band.

Filtering can be automatically applied when starting a new analysis (*File/Configuration/Edit* menu, *New analysis* tab).

# VII.4 Building pauses

(Tools/Build pauses menu)

Although it may seem a basic notion, a pause, i.e. a moment where the participant is not drawing /writing has to be build.

There is two sorts of pauses, whose scientific status is not well defined:

- when the pen is "Up", above the paper. It is not drawing, but can be moving, or not. Is it a pause, or not ?
- When the pen is stopped "Down" on the paper. With high resolution tablets devices, it is never . So a criterion has to be determined to say when it is considered to be stationary or not.

To set the parameters, open the *File / Configuration / Edit* menu, *Tools* Tab, and click on the *parameters* button of *Tab data, Pauses building*.

The first two checkboxes allows to select which sort of pause you want to be build upon selecting the *Tools/Build pauses* menu: Up and/or Down.

€ <sub>P</sub> Build pauses	23
Pauses to build	 
Build Op pauses	
Build Down pauses	

Figure 98: Selecting which pause sort to build.

Below follows each method selection and settings.

# VII.4.1 Build Up pauses

Building a "pen up" pause consists in grouping data when the pen is above the tablet. Then, there is no option to set.

#### VII.4.2 Build down pauses

Building a "pen down" basically consists in grouping data that we regard as representing the same event: the pen stops moving at a given place for a given duration.

This tool aims as well to compensate for the excessive sensitivity of some tablet models. For example, if a participant is asked to keep the pen still on the tablet in a vertical position, the coordinates may not be stable and instead vary around a central ("middle") position, due to slight vertical tremor on the part of the participant. However, as far as the study of writing is concerned, the coordinates of the pen tip on the surface should not change.

Three methods are proposed.

#### VII.4.2.1 Same coordinates

This is the most basic method: two (or more) consecutive samples with the same coordinates are grouped as one unique sample.

€ <sub>P</sub> Build pauses	
Pauses to build	
✓ Build Up pauses	
🗹 Build Down pauses	
<ul> <li>Method to build down pauses</li> </ul>	
Same coordinates	
Barycenter method	
Calculation parameters	
Minimum duration to start a pause (in millisecor	nds) 20 🖶
Deviation threshold (in tablet lines)	5
Agregate successive period at a with speed below (line)	s/ms) 0.02
	ormoj ovoz
	OK Cancel

Figure 99: Building pauses, same coordinates method.

# VII.4.2.2 Barycenter method

#### Method

This method belongs to the same family as the fixation computing process (cf. "Barycenter method", p. 102): if several successive points are located within a defined perimeter, they are deemed to be part of a single "pen down pause". The whole group of points is then substituted by its barycenter.
**Caution**: the warning about building fixations also applies here, because building down pauses modifies the number of samples/events in the protocol.

Before using this tool, you should be aware that there are two inherent difficulties:

1) because of the type of method used, the duration of an existing "pen down" pause may be lengthened by the addition of the duration of subsequent points that fall below the deviation threshold;

2) slow tracing may be discretized, i.e. cut into a series of successive pauses. In which case it is advisable to choose as small a "*Deviation threshold*" as possible and a sufficiently large value for "*Minimum duration to start a pause*". You may find help in choosing this value in the relevant literature. For example, when studying the handwriting of adults, a pause lasting more than 150 milliseconds can be regarded as relevant.

This tool should therefore be used carefully and only when needed.

€ <sub>P</sub> Build pauses	X
Pauses to build          Image: Pauses         Image: Pause Pause Pause         Image: Pause P	
Method to build down pauses  Same coordinates  Barycenter method  Calculation parameters  Minimum duration to start a pause (in milliseconds)  Deviation threshold (in tablet lines)	15 💽 9 💽
Aggregate successive pen data with speed below (lines/ms)	0,02
	OK Cancel

Figure 100: Building down pauses, barycenter method.

"Pen down" pause computation is based on two parameters:

- The minimum duration for starting a pause (in milliseconds).
- A deviation threshold (in tablet units): a radius around the first point regarded as the pause origin. To help you determine the deviation threshold, you can use the tablet test menu (see Tablet visual test, p. 38). For example, given that the smallest distance reported by my tablet is 8 units, I would choose 8, with the aim of calculating pauses taking data clustered within a "1 point" radius into account.

VII.4.2.3 Speed

This method relies on a simple assumption: when pen position is nearly stationary, its mouvement speed tends toward a very low value, near to zero.

€ <sub>P</sub> Build pauses	
Pauses to build	
🔽 Build Up pauses	
📝 Build Down pauses	
Method to build down pauses	
Same coordinates	
Barycenter method	
Calculation parameters	
Minimum duration to start a pause (in milliseconds)	15
Deviation threshold (in tablet lines)	9
Aggregate successive pen data with speed below (lines/ms)	0,02
	OK Cancel

Figure 101: Building down pauses, speed method.

Aggregate successive pen data with speed below	Aggregates successive pen data (pen being pressed on the tablet moves slightly) relative to a speed threshold.
(lines/ms)	This threshold must be empirically determined. It is expressed in lines (tablet counting unit) per millisecond.
	All successive moves (samples) with a speed below this threshold will be clustered into a single point.

## **VIII. VISUALISATIONS**

#### VIII.1. Introduction

The Eye and Pen visualisations functions allow you to represent data in a static and visual way, in three modes:

- As <u>circles</u> projections: fixations or pauses are represented as circles with a diameter reflecting the duration (optional). Movements can be traced from one circle to another.
- As <u>colors</u> "map" showing the importance of events in relation to the total length of the protocol. The darker the color, the shorter the duration, the redder the color, the longer the duration. Pauses, fixations and Gaze to pen distances can be represented.
- As <u>graphs</u> showing the gaze and pen position movement over time, either as orvelaid graphs (all in the same graph), or side-by-side (each data type in its own graph).

**Note**: the Circles and Colors visualisation mode can be used in conjunction with the "*Shift layers*" tool (see p. 118)

The screen display is composed of the background picture (or background color) and the participant's final product.

To make this easier to grasp, all the following illustrations are taken from the same protocol.

## VIII.2. Visualisations configuration

See <u>chapter 1</u> p. 58.

## VIII.3. Visualisation as "Circles"

(Visualisations/Circles menu)

You can launch this preview to show:

- pauses;
- fixations ;
- AOI scanpath;

## VIII.3.1. Pauses

(Visualisations/Circles/Pauses menu)

Pauses durations are represented as circles with their diameters indexed on the pauses durations (the longer the pause is, the bigger the circle is).

but the B les câlles

Figure 102: Pauses visualisation with empty circles.

# VIII.3.2. Fixations

## (Visualisations/Circles/Fixations menu)



Given the options chosen, you may get something like this:

Figure 103: Visualisation of fixations.

If you select the option to include eye movements, you may get something like this:



Figure 104: Visualisation of fixations and eye movements.

## VIII.3.3. AOI scanpath

(Visualisations Circles/AOI scanpath menu)

To obtain a useful and meaningful preview, you must first build fixations and define the AOIs.

You will then be able to visualize groups of fixations and their route across the AOIs. Each series of fixations on the same AOI is combined into a group, represented by a circle located at the coordinates of the center of that group.

Depending on the chosen options (see Visualisations configuration, p. 58), the size of the circle representing a group of fixations will be relative to the summed duration of the fixations in the group. Successive groups will be connected by a line and the circles will be numbered in chronological order.

- Quoi 7 demanda-t-11 avec	nargne anurissement, distraction et geni
- Je vous dérange	
- Oui oui merci.	
Elre <sup>5</sup> 3' approcha des rayons	s, fit une pile de livres qui tombèrent.
-Vous avez termine vos	recherches bibliographiques ? demar
gravement, en faisant avec	ordelière de sa robe moirée un mour
menaçant de fronde.	<u>)</u> (

Figure 105: Visualisation of AOI scanpath.

## VIII.4. Visualisations as "Colors"

(Visualisations/Colors menu)

In this visualisation mode, durations are represented by colors, as a "thermograph". You can launch visualisations as "Colors" showing:

- Pauses
- Pauses classified according to duration
- Fixations (takes the foveal vision size into account)
- Gaze to pen distance

VIII.4.1. Pauses

(Visualisations/Colors/Pauses menu)

Color represents pause duration in relation to the whole set of pauses. Pauses are represented by a rectangle at the place where the pen left the tablet or became immobilized.



Figure 106: Pause preview as colors.

# VIII.4.2. Pause duration classes

(Visualisations/Colors/Pauses by duration classes menu)

In this preview mode, pause durations (in milliseconds) are classified as follows:

0	30	60	80	100	120	150	200	400	800	1200	2000	

The right section of the scale shows the color for pauses lasting 2,000 milliseconds or more.

Below is an example of how they are represented:



Figure 107: Preview of pauses, color-coded according to duration.

# VIII.4.3. Fixations

(Visualisations/Colors/Fixations menu)

This preview mode only shows the fixation durations on the protocol.

Below is an example of a protocol preview in this mode (foveal vision diameter is 30 pixels; see <u>Visualisations configuration</u>, p. 58).



Figure 108: Fixation preview in "temperature" mode.

"Hotspots" represent the areas of greatest fixation duration.

## VIII.4.4. Gaze to pen distance

## (Visualisations/Colors/Gaze-Pen distance menu)

This visualisation mode allows to make visible tracing locations where the distance between gaze and pen location are away from each other. Obviously, a distance threshold and a specific color of display can be set (see *File/Configuration/Edit* menu, *Visualisation* tab).



Figure 109: Gaze to pen distance visualisation.

In the above example, parts of words tracing are displayed in purple, eliciting when gaze location is away from writing.

To select a threshold distance value, one may refer to foveal vision (1 to 1,5 degree) or peripheral vision diameter (about 2 degree).

## VIII.5. Data visualisation as "Graphs"

#### (Visualisations/Graph menu)

Data representations available in the sub-menus of the *Visualisations/Graph* menu are all curve-based representations.

Two modes of representation are available: "Overlaid" or "Side-by-Side".

When selecting one of these graphs, a data selection panel ("Graph options") is first displayed.

$\epsilon_p$ Graph options	and the second second			23
Data to display				
Dxy-tab	Vxy-tab	Dxy-eye	Vxy-eye	
☑ Dy-tab	Vy-tab	Dy-eye	Vy-eye	
☑ Dx-tab	Vx-tab	Dx-eye	Vx-eye	
y-tab		🔲 у-еуе		
x-tab		x-eye	Dxy-Tab-eye	
V Press				
Sequences				
Options				
Display 20	seconds at a time			
Limit series values	to +/-			
Limit series values	to +/- 0 🚔 s	standard deviations		
V Display vertical ba	r at pen up			
			Ok Cancel	

Figure 110: Graphs display options.

The "*Data to display*" frame allows to select, well, which data you want to be displayed. Option explanation is given for tab sample, but is also applicable to Eye sample, when Eye is mentioned between brackets.

LABEL	DESCRIPTION		
Dxy-Tab (Eye)	Euclidean distance from the previous Tab sample		
Dx-Tab (Eye)	Euclidean horizontal distance from the previous Tab sample		
Dy-Tab (Eye)	Euclidean vertical distance from the previous Tab sample		
Y-Tab (Eye)	Vertical coordinate of Tab sample		
X-Tab (Eye)	Horizontal coordinate of Tab sample		
Vxy-Tab (eye)	Absolute speed from previous Tab sample		
Vy-Tab (eye)	Vertical speed from previous Tab sample		
Vx-Tab (eye)	Horizontal speed from previous Tab sample		
Dxy-Tab-Eye	Absolute distance between Tab and Eye location		
Pressure	Pressure value of Tab sample		
Sequences	When selected, displays sequences at the bottom of the graph, with their descriptors.		

The "*Options*" frame allows to fine tune data display.

LABEL	DESCRIPTION
Display [X] seconds at a time	Time range that will be displayed at a time ("in a screen").
Limit series values to +/-	This option aims at limiting series values to a range you set. This may be used to avoid that series display is "flattened" by a small subset of great value.
Limit series values to +/- [X] standard deviation	Like the previous option, this option aims at limiting series values, but uses the standard deviation of the series as a criterion. You set the number of standard deviation (i.e. the number multiplying the standard deviation calculated value) that will serve as upper and lower bound.
Display vertical bar at pen up	When selected, the option will display vertical grayed bars, whose width will match pen up duration.

Both of values limitation methods can be used at the same time. Then, Eye and Pen will use an order of implementation which is:

1- Standard deviation 2- Values

This order is important because standard deviation calculation result will be different if values would have been modified first !





Figure 111: Data visualisation as overlaid series.

In this visualisation mode, all selected data are superimposed in one unique graph. In the example above, only tablet data have been selected: horizontal motion (Dx-tab); vertical motion (Dy-tab) pen pressure; sequences at the bottom; vertical bar (grayed stripes) while pen is up.





Figure 112: Data visualisation as side-by-side series.

In this visualisation mode, all selected data are shown on separate "lines", one for each. In the example above, data where: horizontal motion (Dx-tab); vertical motion (Dy-tab); pen pressure; sequences (at the bottom of the graph); vertical bar (grayed stripes) while pen is up.

Graph axis scales are automatically resized according to the data being displayed.

Be careful about memory capacity: displaying a graph with 6 curves for a 517,000 data protocol (total of Tab and Eye data for a full page of writing produced in about 20 minutes) takes up approximately 130 Mb of RAM memory.

Graph windows may be resized with the mouse: when the mouse cursor hovers over the lower right-hand corner of the windows, it turns into a diagonal double arrow. Press the left mouse button and, keeping the button pressed, move the mouse in the direction you wish the windows to resize. The window will resize in line with your movement.

Inside the windows, you can zoom in/out and have the graph scroll up/down and horizontally, as is the case for the graphs displayed for the protocol statistics (see p. 136).

## IX. SHIFT LAYERS

(*Tools/Shift layers* menu)

During data acquisition, the data may not necessarily be where they should be (they have "slipped") because:

- the sheet of paper on the tablet has moved (or been moved);
- even if the participant's head has been immobilized, s/he has nevertheless succeeded in moving slightly;
- headmounted evetracker may slightly slip on the participant's head;
- etc.

Eye-tracking data therefore move in relation to the tablet data and background picture.

If the participant was writing on a sheet of lined paper and we use an image of this sheet as a background for analysis (see <u>configuration</u>), we can see that the writing is not where it should be.

# To make it easier to track down these "displacements", apply the following tip prior to data acquisition:

Put (draw) a cross in the middle (or a more convenient place) of the production medium – sheet of paper, background picture, etc. - and ask the participant to fixate this mark for approximately 20 seconds. Next, ask the participant to draw over this cross with the pen. You can now start your experimental recording.

The participant's first fixation will therefore be on the cross. If a shift of data does occur, this first fixation will be a good way of spotting the problem and helping to align the data. The principle is the same for both writing and drawing: the participant's cross must be on top of your cross!

After the experimental recording, ask the participant to draw the cross again and to fixate it. This will be a way of checking that the data are still "well in place".

To limit this risk, you can try "fixing" the paper, e.g. using plastic corners on the tablet into which you can slide the sheets.

**In the analysis stage**, a "Temperature" preview (see page 113) may help you detect this kind of flaw and correct it by shifting the layers.

<u>Recall</u>: to have all the data in the same coordinates system, eye tracking data must be converted into the tablet coordinates system.

We regard the protocol as being made up of 3 superimposed layers: the screen background (color or background picture) represents the bottom layer, the tablet data are "sandwiched" in the middle layer, and the eye tracking data make up the top layer (third level). The reference level is the tablet data layer.

To re-adjust these layers, click on the "*Tools*" menu, then select "*Shift layers*". The following dialog box will be displayed.

Shift layers	
Eye data shift (in tablet lines) Vertical shift 🔋 😴	Horizontal shift 0
Background shift (in tablet lines) Vertical shift 0	Horizontal shift 0
ОК	Cancel Apply

Figure 113: Dialog box for adjusting the position of the layers.

This box has two frames (parts), labeled:

- Eye data shift (in tablet lines): horizontal and vertical movement applied to all eye samples.
- Background shift (in tablet lines): horizontal and vertical movement applied to the background picture.

As the tablet data layer is the reference, it is never "moved".

There are two ways of shifting the eye data or the background layer: using the computer mouse or using numerical values.

# Numerical shift of the layers

Set the number of tablet units you want the layers to be moved by, in the "horizontal shift" and/or "vertical shift" boxes.

Click on the "*Apply*" button to... apply the desired shift to layer(s).

<u>Caution</u>: the "*Apply*" button will validate your entries, but there is then is no way back except by setting new values.

If the applied shift has the desired effect, click on the "*OK*" button to close the dialog box. If not, modify the values again or click on "*Cancel*" to close the dialog box.

# Visual (and convenient) layer shift

Click with the right mouse button on the "start location" of the shift.

Then, keeping the button pressed down, move the mouse to the place where you want that point to be located. A dotted line will connect the starting point to the mouse cursor.

Shift layers			
– Eye data sh Vertic	ift (in tablet lines) al shift 0	Horizontal shift 0	۲
Background Vertic	d shift (in tablet lines) al shift 0 😭	Horizontal shift 0	۲
	OK	Cancel	pply
ĝ		garnemento	app

Figure 114: Setting a layer shift using right mouse button selection.

Release the mouse button and go the contextual menu (pops up to the right of the mouse cursor) if you want to shift the eye-tracking data layer or the background picture.

Shift layers Eye data shift (in tablet lines) Vertical shift 0 🕞	Horizontal shift 0
Background shift (in tablet lines) Vertical shift 0	Horizontal shift 0
OK	Cancel Apply
Shift	background Eye data

Figure 113: Selecting the layer you want to move using a contextual menu.

Values in the "Shift layers" dialog box are automatically updated and applied.

Shift layers	
Eye data shift (in tablet lines) Vertical shift 346 😭	Horizontal shift 99 🕞
Background shift (in tablet lines) Vertical shift 0	Horizontal shift 0
ОК	Cancel Apply

Figure 114: Shifting values are updated in the dialog box.

# X. DATA CODING

# X.1. Manually-coded data

The coding tool provides information on the event currently being observed in the protocol, but also allows you to attach a code to the data.

Below the "*N*" box of each data type (Tab or Eye), you will find a column with a list of numbers (from -1 to 127).

This column is used to assign codes to the data.

Each data item can be given a code from -1 to 127.

By default, each data item is coded "o" (neutral code).

# Every data item coded -1 will be excluded from calculations and editing.

To code a data, click on a number in the column corresponding to its type (Tab or Eye).

## Each item can only have one code.

## X.2. Coding an item of tablet data when in trigger zone 1 or 2

(Tools/Tablet zone auto-coding menu)

The "Eye and Pen" program has tools which automatically code the tablet data "passing into" trigger zones 1 or 2 (defined in the configuration panel, "Simple" tab).

Click on the "*Tools*" menu, then select "*Tablet zones auto-coding*…". The following dialog box will be displayed.



Figure 115: Automatic coding of data in trigger zones.

Enter a code number (between 1 and 127) in the "*Pen down in trigger zone 1*" box.

Enter a code number (between 1 and 127) in the "Pen down in trigger zone 2" box.

Click on the "OK" button to automatically attach these codes to the tablet data "located" in these zones.

Note:

Each line of the dialog box is enabled only (and thus the corresponding zone taken into account in analyses) if the corresponding "trigger zone" option is selected (ticked) in the Simple paradigm configuration (*File/Configuration/Edit* menu, *Simple* tab).

# X.3. Assigning the -1 code to "Eye" data beyond the calibrated area

(*Tools/Code -1 "out-of-field" Eye data* menu)

If you want to automatically assign the code **-1** to eye-tracking data located beyond the calibrated area (i.e. generally speaking, outside the analysis screen), there are two solutions:

- tick the "*Code -1 out-of-field data*" box in the "*New Analysis*" tab of the analysis configuration panel (optionally tick "*aggregate successive out-of-field data*");
- click on the "Tools" menu, then on "Code -1 out-of-field Eye data".

The of using the "*New Analysis*" configuration for automatic coding is that you have to be sure that the data are properly "set up" (see "Shift layers", p. 118), otherwise you risk tagging valid data as invalid.

Please note that the "-1" code can be assigned to any type of data.

# X.4. Coding "Eye" data in the Visual Zones (AOI)

(Tools/Visual zones (AOI) menu)

<u>A Visual Zone</u> (often found as "*Area of Interest*" in the literature, or AOI) is a rectangular area of a protocol in which we consider the eye movements and fixations to be of particular interest.

To automatically code Eye data in a particular zone of the protocol, you must first define this Area Of Interest with the help of a specific tool. All data in this zone will then be coded with the associated code.

## **Important:**

AOI-based processing is managed according to the order of AOIs in the list. When two zones share a common area(s), the last AOI in the list will "have the last word" when it comes to coding.

e.g. if, after a first zone has been defined, a second zone is defined, partially overlapping zone 1, data in this "dual zone" area will be given zone 2 coding.

To define an AOI, click on "*Tools*" and select "*Visual Zones (AOI)*". The following dialog box will be displayed.

AO	l definitior	า			7318 7304	8149 10324	14882 14924	10324 12386	15 16	Quinze Seize	-
<1	8648	🖥 Y1	7520	8	7318	12371 8146	15122	14214	17	Dix-sept	
<2	13022 8	- 	8053		-101	10310	7290	12367	13		_
				-	571	12352 525	7321 2293	14196 8084	14 1		=
Lab	bel	Code	4	۲	2308	525 525	3954 6216	8099 6095	2		
					6316	525	8023	6910	2		
					9974	906	13083	2750	3	essai de grand libellé	
					10096	10096	12961	70096	3	essai d'un autre grand lit	2
	Add		Delete		0017	5001	11000	7330 anc	3		Ψ.
					•			1	11	•	
	A <u>O</u> I file	C:\Use	ers\che:	snet\D	ocuments	\Eye an	d Pen 2'	\data\te	stAOL.	A0I	2

Figure 116: AOI definition/selection panel.

## To define an AOI, follow the steps below.

STEP	DESCRIPTION
1	Click with the left mouse button on the place where you want the AOI to begin (its upper left-hand corner) in the protocol.
2	Keeping the button pressed down, move the mouse toward the right, then down. You have now created a rectangle which you can adjust by moving the mouse.
3	When you are satisfied with the result, release the mouse button. The coordinates of the selected zone will be updated in the boxes labeled <i>"X1</i> ", <i>"Y1</i> ", <i>"X2</i> " and <i>"Y2</i> ".
4	Type the code value you want to be associated with this zone in the " <i>Code</i> " box.
5	Type a label (optional) in the "label" field. This label is only used to help manage AOI easily and more "readable" than numbers. It is not used in data extractions.
6	Click on the " <i>Add</i> " button to add this new AOI to the list of AOIs (in the frame labeled " <i>AOI list</i> "). Each line of this list contains " <i>X1</i> ", " <i>X2</i> ", " <i>Y1</i> ", " <i>Y2</i> " and " <i>Code</i> ".

Please note that when saving your analysis, existing AOI are saved at the time, and will be reloaded with the analysis when you later reopen it. The AOI file will be named from your protocol name, with the ".AOI" extension.

You can manually save or load your AOI lists in order to use them again another time, or with another name.

**To save an AOI list**, click on the "floppy" icon in the lower right-hand corner of the dialog box. A "*Save as*" dialog box will be displayed. Choose a name for the file and click on "*Save*". The full path and filename of this file will be updated to the right of the "*AOI file*" label.

**To load an AOI list** you created earlier, click on the "opened folder" icon. A dialog box will be displayed where you can select an "AOI" list file. Click on the "OK" button to load and open this list. The "*AOI list*" will be updated.

**Hint:** the keyboard shortcut of the label "A<u>O</u>I file" (<alt+o>) select the "Open" icon. Then, you just have to pres on the <enter> key to open the dialog box to load an AOI list file.

## Modifying the AOI List

**To select an AOI**, click on the corresponding AOI line in the "*AOI list*". This AOI will be displayed on the protocol as a "darkened" rectangle.

The Up and Down arrow to the right of the list allows you to move up or down the items in the list. This means you can modify the order of items in the list.

**To delete an AOI**, select it in the "*AOI list*", then click on the "*Delete*" button in the "*AOI definition*" frame.

The selected AOI will be erased from the list.

Visual zones (AOI) Area of Interest AOI definition X1 7318 ♥ Y1 12371 ♥ X2 15122 ♥ Y2 14214 ♥ Code 17 ♥ Label Dix-sept	AOI list 7318 8149 14882 10324 15 7304 10324 14324 12386 16 7318 12371 15122 14214 17 -101 8146 7260 10310 12 -101 10310 7290 12367 13 -101 12352 7321 14196 14 571 525 2293 8084 1 2308 525 3954 8099 2 4609 525 6316 6895 1 6316 525 8023 6910 2 9974 906 13083 2750 3 10096 10096 12961 10096 3	Quinze Seize Diwsept
Add Delete	00055 5661 13006 7398 3	
	(	Apply codes Close

Figure 117: AOI selection panel.

If you click on the "*Close*" button without having clicked on "*Apply codes*" before, the AOI list won't be lost. If you re-open the panel, you'll find it again.

When defining AOIs, make sure you take into account the participant's foveal vision radius. An over-restrictive definition may lead to under-estimated gaze durations in these zones.

For example, I want to study gaze durations for a photo of a desk. I am particularly interested in an object lying on the desk. I therefore define an AOI around this object. When the participant's gaze approaches the "boundary" of this object, the coordinates of the gaze may be a few pixels outside the AOI, even though the participant is actually looking at this object. The amount of data "involved" will therefore be under-estimated. The reason for this is that the participant not only sees what is at the exact center of his/her line of sight, but also what is within a certain perimeter, i.e. foveal vision.



Figure 118: Foveal vision at the edge of a visual zone (AOI).

You may therefore need to define an AOI that is larger than the item you wish to study.

## AOI and background picture

If you save an AOI list in the directory where the background picture is, using the same name, you can use the option *"If an AOI file exists for the current background picture, apply to data"* (File/Configuration/Edit menu, New analysis tab, see page 51).

This means that you may create a default AOI list for a particular background picture, and automatically load it to when creating a new anaysis.

# X.5. Erasing all the codes

(Tools/Erase codes menu)

Reset codes	<b>— X</b>
Select data type	© EYE
TAB	o zero
Reset codes to	OK Cancel

*Figure 119: Selecting the type of data for resetting the codes.* 

Tick the data category (Tab and/or Eye) where you want the data codes to be **reset to zero**. Simply click on the "OK" button: now, none of the data in the selected data type has a significant code anymore.

## X.6. Replacing one code with another

(Tools/Replace codes menu)

You want to substitute one code for another for a particular type of data (Tab and/or Eye). The following dialog box will be displayed.

Replace codes			X
<ul> <li>Select codes v</li> </ul>	alues	Nama	
	Current value	New Value	
TAB	0	0 🛢	
	-		
V EYE	3 😇	30 🕃	
		ок с	ancel

Figure 120: Replacing the codes given to the data types.

To change a code, follow the steps below:

STEP	DESCRIPTION
1	Choose the data type you want the modification to apply to, by ticking the <i>"Eye"</i> and/or <i>"Tab"</i> boxes.
2	In the " <i>Current value</i> " column, enter the code value(s) you want to be replaced.
3	In the " <i>New value</i> " column, enter the new code value(s).
4	Click on the "OK" button to apply the modification to your data.

# X.7. Word separation

(Tools / Word separation Menu)

The word separation tool is <u>not</u> an optical character recognition (OCR) tool. It is a semi-automated method of "locating" words.



Figure 121: Word separation menu items.

To handle the word separation data, you can use the "*Tools/Word separation*" menu that allows you to start/resume loading or save these data.

Based on this "segmentation", you will have the option of:

- creating sequences
- coding Tab data at word boundaries
- coding the pauses between two successive words
- building AOIs around these words.

The "*Save as*" sub-menu allows you to save the current word separation data in a different (separate) file. Type in a name for the file and click on "Save" to validate.

The "*Open*" menu allows you to load a previously saved word separation data file. A dialog box appears in which you can select a word separation data file (\*.WDS). Click on "*Open*" to validate and the data will be loaded.

Word separation data files allow you to have more than one set of separation data for a single protocol, which you can then use according to your needs (e.g. different types of data extraction). You can even use the same separation data for different protocols (e.g. if a participant wrote word in "fields").

Separation data are automatically saved (and reloaded) with the protocol (as for sequences).

Word separation is carried out in two steps: the first step consists in overall, automated location (the best adjustment that correctly separates the most words), while the second step consists in manually refining the separation and adding information for each individual word.

The first step is managed via the "*New*" submenu, whereas the second step is initiated via the "*Continue*" submenu.

# X.7.1. Step 1: overall tuning

Word separation basically consists in locating the basic units made up of writing data between two "pen up" pauses.

Word separation					- X
fine tune					
Start time	0	\$	End time	40193	\$
Horizontal margin	22	\$	vertical margin	8	\$
Exclude items sma	iller than :				
Horizontal 10	\$	Vertica	al 10 🌻		
[Smallest elem	ent size: 1	0 x 17 ]			
🔁 Test	N	umber of	words detected:	11	
	size	s are exp	pressed in (pixels »	: 10)	
			💿 <u>C</u> ontinue	e <u>C</u> a	ancel
In damene auf	crieffe	epir	ต (ซากายาย เป็นการการการการการการการการการการการการการก	- upl t	WBL 0

Figure 122: Word separation, step 1.

This first dialog box is used to manage the overall word scanning. As soon as it appears, an initial separation is proposed (in the protocol, words are surrounded by a border to visualize the result of the separation process, as in the above figure).

If the proposed separation satisfies your needs, click on the "*Continue*" button. If not, you can modify and edit the separation parameters and click on the "test" button to see the result of the separation with your new parameters.

The "*Fine tune*" panel fields and buttons are explained below:

LABEL	DESCRIPTION
Start time	By default, this field indicates the protocol's start timestamp. You can edit this field's content to restrict the separation to a certain period of time within the protocol.
End time	By default, this field indicates the protocol's finish timestamp. You can edit this field's content to restrict the separation to a certain period of time within the protocol.
Horizontal margin	Defines the horizontal space added to the size of each word. If the edges of two "words" touch and are temporally successive, they are grouped together as a single word. This parameter helps, for example, to "stick" together parts of a word that have been separated (writing style), etc.
Vertical margin	Defines the vertical space added to the size of each word. If the edges of two "words" touch and are temporally successive, they are grouped together as a single word. This parameter helps, for example, to "stick" together signs added to the nearest words, such as dots on "i"s, etc.
Exclude items smaller than	If you tick this checkbox, all the "words" that are smaller than the horizontal and vertical minimum sizes that you have defined will not be isolated as "words". This function may come in useful for

	discarding punctuation signs, for example.
[ Smallest element size ]	Shows the horizontal and vertical sizes of the smallest "word" in the current separation configuration. This information may come in useful for adjusting edges or defining the size of elements to be excluded.
Test	Click on this button if you have modified any of the parameters in the "Fine tune" panel, in order to update the display of the word separation result.

Once the parameters have been adjusted, click on the "Continue" button.

A new window will then enable you to fine-tune (or correct) each separated word (you can directly access this step via the "*Continue*" submenu, if the first step was completed earlier).

# X.7.2. Step 2: word-by-word adjustment

Fine-tuning, word by word, allows you to modify the events regarded as beginnings and endings, codes and attached labels. "Up" pauses are used as delimiters, but are not included within the word boundaries.

Word sepa	ration 🛛 🛛 🔁				
details Word n	umber 1 호 🛐 👩 [Total: 11]				
Start End	T ab number         pressure         code           ↓         1         ▶         92         10 €           ↓         53         ▶         298         11 €				
Text 1 Text 2					
Text 3 ✓ Code Tab data at word boundaries ✓ Code inter-word pauses ✓ Create sequences for words ✓ Create AOI for words					
In Granel al	<u>Dek</u> <u>Cancel</u>				

Figure 123: Word separation, step 2.

This panel helps you to review each word and add one or more labels to each one. The fields and buttons in the "*Details*" panel are described in the following table:

LABEL	DESCRIPTION			
Word number	Shows the number of the current "word". Click on the Up and Down arrow on the right side of the field to move forward/backward from word to word. You can also use keyboard shortcuts:			
	<ul> <li>Alt + left arrow: previous word;</li> <li>Alt + right arrow: next word;</li> </ul>			

	<ul> <li>Alt+End: last word;</li> </ul>
	<ul> <li>Alt+Home: first word.</li> </ul>
	When the current word changes, the cursor moves to the "Text 1" field.
	Clicking on this button will create a new word. It will be inserted after the current word (highlighted). All subsequent words will be re- numbered from the current word onward (you will find a more detailed explanation below).
10/	Clicking on this button deletes the current word. All subsequent words will be re-numbered, the word next to the current word taking its number and so on (you will find a more detailed explanation below).
[Total]	Shows the number of separated words.
Start	Shows data relating to the beginning of the current word.
End	Shows data relating to the end of the current word.
Tab number	Tablet data number in the protocol. Buttons to the left and right of the number allow you to move forward or backward through the tablet data (where possible).
Pressure	Shows the value of the pressure exerted on the pen for this tablet data.
Code	This field displays the code value that will be associated with the tablet data if you select the "Code Tab data at word boundaries" option (first and last tablet data of the word). To change this value, click on the Up or Down arrow button to the right of the field or type a value of between 0 and 127.
Text	Descriptor (label) linked with the word. The number of lines available to describe the "word" is defined in the File/ <i>Configuration/Edit</i> menu, <i>Tools</i> tab.
	If you wish to generate sequences based on "word separation", these lines will be assembled and given a single sequence descriptor.

X.7.2.1 delete a word

To delete a word, make it the current word.

In the following example, we wish to delete the coma (word number 7). We use the arrows 🖆 in the "Word number" field to select this word.

Word separ	ration		X
details Word nu	umber 7 🚖 📑	presente code	[ Total: 11 ]
Start	oli 10 10 10 10 10 10 10 10 10 10 10 10 10	260 Delete this word	1 I
End	oli 1848 🛛 🔁	218 11	\$
Text 1			
Text 2			
Text 3			
Code Ta Code int Code int Create s	ab data at word boundaries ter-word pauses tequences for words AOI for words		
		<u>0</u> k	Cancel
Ju gawen	ve dirifanthe foob	into more	und tape

Figure 124a: A "word" deletion.

Next, we click on the "trashcan" icon to delete the word.

The word that was previously word no.8 becomes the new number 7. Each of the subsequent words will be re-numbered as well.

Word separ	ation		$\overline{\mathbf{X}}$
details Word nu		0	[Total: 10]
Start	850	pressure 62	code
End		488	11 🛨
Text 1			
Text 3			
✓     Code Ta       ✓     Code int       ✓     Create s       ✓     Create A	ab data at word boundaries er-word pauses equences for words x01 for words		
			<u>O</u> k <u>C</u> ancel
ju gawen	ne quillautte loop	innter / na	were work twoe

Figure 124b: Deletion of a "word" (new current word).

X.7.2.2 Inserting a word

To be able to insert a word, there must be enough room, otherwise room must be made for it. In the following example, the "overall" separation (step 1) combines two written words within a single "unit" (highlighted): word 5, "les pirates" ("the pirates", in French).

Word separ	ration			×
details Word nu	umber 5 🚊 📑	0		[Total: 10]
Start	Tab number	pressure 134	code 10 🚖	
End Text 1		24	11 🚖	
Text 2 Text 3				_
Code Ta	ab data at word boundaries ier-word pauses iequences for words ADI for words			
			<u>0</u> k	<u>C</u> ancel
ju gawen	ne qui lauette lo	pirates pre	ານອີນຂຶ້ນຖາ	el tape

Figure 125a: Inserting a "word" (resizing).

We can "shrink" this unit to the first written word with the help of the  $\leq$  button of the end of word Tab data. By clicking on this button, we move the end of word to the left (the selection width is reduced). In the process, we also free up some space in the protocol (no longer assigned to "separated words").

Word separation
details Word number 5 😴 🛐 🔟 [Total: 10]
Tab number pressure code Start 刘 561 🍃 134 10 🌩
End 🚺 633 🕨 144 11 🛫
Text 1
Text 2
Text 3
<ul> <li>Code Tab data at word boundaries</li> <li>Code inter-word pauses</li> <li>Create sequences for words</li> <li>Create AOI for words</li> </ul>
<u>D</u> k <u>Cancel</u>
In annewe qui loue He lo pinto anovene und tame

Figure 125b: Inserting a "word" (size of word reduced).

Insertion can now take place in the space freed up after the current word. We click on the button to insert a new word. The new word's Tab data will encompass the whole space left free between the current word and the next word.

Word sepa	ration 🛛 🛛 🔁
details Word n	umber 🗧 💼 [Total: 10]
Start End	Tab number     Variable     code       635     Insert a new word after current word       839     114
Text 1	
Text 3	
Code Tail Code in Create a Create a	ab data at word boundaries ter-word pauses sequences for words AOI for words
	<u> </u>
la quiveli	re quilleur He lopinto moure une tone

Figure 125c: Inserting a "word" (new word is added).

The inserted word becomes the new no. 6 and each of the following words is re-numbered.

Word	number 1 😴	<u> </u>		[ Total: 8 ]
	Tab number	pressure	code	
Start	1 📐	1023	10 凄	
End	al 183 🛛 💽	94	11 凄	
Text 1				
Text 2				
Text 3				
<ul> <li>✓ Code T</li> <li>✓ Code ir</li> <li>✓ Create</li> <li>✓ Create</li> </ul>	ab data at word boundari ter-word pauses [9] sequences for words ADI for words	es [10 / 11]		

X.7.2.3 What to do with separation data

Figure 126 : selecting operations to perform on word separation

The frame at the bottom of the window, lists actions that can be performed based on word separation data when the "OK" button is clicked:

LABEL	DESCRIPTION
Code Tab data at word boundaries	If this checkbox is ticked, the codes associated with the first and last Tab data for each word will be applied to the protocol coding. These codes are visible in the coding tool (p. 88) when you "navigate" in the protocol.
Code inter-word pauses	If this checkbox is ticked, the pauses (Up or Down) between two "words" will have their codes in the protocol replaced with inter- word codes (defined in the <i>File/Configuration/Analysis</i> menu, <i>Tools</i> tab).
Create sequences for words	If this checkbox is ticked, a sequence will be generated for each "word" and its descriptor will be appended to the list of sequences. The start time of the sequence will be the timestamp for the word's first Tab data (or of the pause preceding the word, depending on the chosen options). The sequence's end time will be the timestamp for the word's last Tab data.
Create AOI for words	If this checkbox is ticked, a visual zone (AOI) will be generated for each word and its descriptor will be appended to the protocol's list of AOIs. The AOI coordinates will be the coordinates of the frames (borders) around each word.

If no action has been selected when you click the "OK" button, a dialog box will prompt for a confirmation before closing.

For example, you may not want to create sequences or codes for data, but simply record the separation data for a colleague who will fill the text fields in later, prior to generating sequences.

The *File/Configuration/Analysis* menu, *Tools* tab, "word separation" frame (see p. 60) allows you to determine the options relating to this section.

# XI. STATISTICAL PROTOCOL DESCRIPTION

(Protocol/Description menu)

In order to help you analyze tablet and eye-tracking data, Eye and Pen can provide statistical descriptions of the data.

Note: events coded -1 (Tab and Eye) are excluded from descriptions.

The following description panel will be displayed.

Note that Up and Down pauses are in separate columns because the option has been selected in the *File/Configuration/Edit* menu *Protocol* tab.

Production Time	duration before pro Product Duration after las	duction 1 ion time 17478 t pen lift 1623		Up pause threshold Down pause threshold Fixation threshold	15 50 10
Details		Stop events		Moveme	nts (samples)
	Up pauses	Down pauses	Fixations	Tab	Eve
lumber	13	0	15	2548	47
otal duration	5618	0	17266	11860	215
otal distance	n/a	n/a	n/a	47,2855	62,0523
tean speed	n/a	n/a	n/a	3,9870	288,6154
finimum	40	0	12	0,0000	5,0000
laximum	1552	0	5155	349,8600	2629,9900
lange	1512	0	5143	349,8600	2624,9900
1	54,0000	0,0000	12,0000	0,0000	14,3750
2 (median)	276,0000	0,0000	384,0000	3,7500	160,5300
3	506,0000	0,0000	1758,0000	6,2500	427,0600
lean duration	432,1538	0,0000	1151,0667	4,6546	4,5745
tandard deviation	469,1156	0,0000	1552,7821	8,6776	496,8760
kewness	1,1410	0,0000	1,3114	0,2606	0,0362
urtosis	0,1725	0,0000	0,6830	10,3424	0,1450
Distance in	i centimeter	Duration in m	nilliseconds	Speed in centimeter	r by second

Figure 127: Statistical description.

The first tab (Statistics) shows quantitative data in two frames:

- *"Production"*: general information about the entire protocol;
- "Details": statistical description of the tablet and eye-tracking data;

The "Production" frame contains three types of information:

• Time duration before production , also called pre-writing pause or pause "zero". This is the duration elapsed between the beginning of the recording and the moment where the participant presses the pen on the tablet for the first time. This value is calculated even if pauses have not been build.

- production duration (pause "zero" is excluded from this duration);
- Duration after last pen lift (formerly called "last pause Up duration"). Usually, this is the last pause before recording stopped. This value is calculated even if pauses have not been build. This is the duration elapsed from the beginning of the last pen Up to the end of the protocol. This duration is included in the "Product duration".

## Note:

In some cases, it may not be the last pause (event) immediately preceding the recording stop. For example, if the recording was stopped by an "Escape" key press or if the participant slipped the pen into the "end" zone without lifting it up. Then, it will be the "last known" pause "Up".

**Hint**: place a thick border (e.g. made of plastic) around the "end" zone to force the participant to raise the pen in order to press it in this "box".

The "Details" frame gives statistical parameters for different categories of information:

- the "stop" events during the written production (Up or Down pauses) and ocular activity (fixations). These parameters are filtered by (see <u>Thresholds</u>);
- the movements of the "eye" or pen.

For each of these categories, the following information is given:

- Number: number of events in the category;
- Total duration;
- Total distance (for "movements");
- Mean speed (for "movements");
- Minimum, maximum, range;
- Quartiles: Q1, Q2 (median) and Q3, the values dividing the distribution into 4 groups. These values are computed on durations for "no movement" events and on speeds for "movement" events;
- Mean duration (for "stops");
- Standard deviation;
- Skew: distribution asymmetry indication. A positive value shows an asymmetry with a "swelling" on the left side. The distribution is skewed to the right;
- Kurtosis: indicates the flatness or otherwise of the distribution shape. A high positive value indicates a "pointed" shape with long "tails", whereas a negative value indicates a "square" shape;

These data may be saved in a text file through the *Extraction/Protocol statistics* menu.

<u>Three different tabs</u> can be used to generate a graphic representation of these distributions:

- "Pauses and Fixations": distribution of pause and fixation durations;
- "Tab Movements": pen movement speed distribution;
- "Eye Movements": eye movement speed distribution;

The last tab "Specifications" details the specifications of the recording devices used.



*Figure 128: Graph showing pause and fixation distribution (logarithmic scale).* 

To **zoom** in on the data: using the left mouse button, select the part of the graph you wish to enlarge, moving from its upper left-hand corner to its lower right-hand corner.



To **cancel**, select part of the enlarged area (its size does not matter) moving from the upper right-hand corner to the lower left-hand corner.



You can move the whole graph with a right mouse click (drag the graph).

"Tab Movements" tab: pen movement speed distribution.



Figure 129: Pen movement speed distribution.



# "Eye Movements" tab: eye movement speed distribution.

Figure 130: Gaze movement speed distribution.

<u>"Specification" tab</u>: shows the properties of the devices (tablet and possibly eye tracker) used to record the protocol.

Element	Value
📚 Tablet	
Recorder	Eye and Pen 2.0
Horizontal display size (screen)	1024
Vertical display size (screen)	768
Tablet origin (X)	0
Tablet origin (Y)	0
Tablet width	7220
Tablet height	5784
Horizontal resolution (lines/centimeter)	200
Vertical resolution (lines/centimeter)	200
Sampling rate (Hz)	200
Cartesian coordinates	Yes
Pressure levels	1024
📽 Eye tracker	
Recorder	Eye and Pen 1.x/2.0
Eye tracker model	Eyelink
Vertical distance between 2 points (degrees)	n/a
Horizontal distance between 2 points (degrees)	n/a
Horizontal number of points	n/a
Vertical number of points	n/a
Horizontal origin	0
Vertical origin	0
Horizontal extend	1024
Vertical extend	768
Sampling rate (Hz)	500
Cartesian coordinates	Yes
Audio recording	None

Figure 131: Protocol recording device specifications.

## XII. USEFUL TOOLS AND FUNCTIONS

## **XII.1. Sequences**

(Display/Sequences menu to show/hide the tool)

Defining sequences is a way of "breaking the protocol down", i.e. creating subsections.

A sequence contains a set of data (Tab and Eye) defined by a beginning time, an ending time and a name (label).

The "Sequences" tool allows you to:

- define a sequence;
- directly "jump" to the beginning of a sequence.

	▶ ► ►	<b>+]</b> 0		740083 740303 . ;;	•	Ø		▶ ◄	Ü
--	-------	-------------	--	--------------------	---	---	--	-----	---

Figure 132: The tool for defining sequences.

ICON	DESCRIPTION						
[+	Set the current time (time elapsed since the start of the data recording, displayed in the " <i>clock</i> " tool) in the protocol as the sequence beginning.						
0	Time at which the sequence begins.						
+]	Set the current time (time elapsed since the start of the data recording, displayed in the " <i>clock</i> " tool) in the protocol as the sequence ending.						
0	Time at which the sequence ends.						
	<b>Create a sequence.</b> Once the times of the beginning and ending of the sequence have been defined, you can create a new sequence and give it a name. When you click on the icon, the dialog box below will be displayed:						
	€p Sequence 🛛						
	Descriptor						
	OK Cancel						
	Figure 133: Describing a sequence. Type the label for the sequence in the " <b>Descriptor</b> " box, then click on the " <b>OK</b> " button.						
	Alternatively, you may click on the button to select a descriptor in a template (see Template for details).						
	The new sequence, with its start and end times and its label, will be added to the drop-down list, to the left of the 🔽 button.						

<b>∢</b>  ►	Splits the currently selected sequence in two, based on the current time in protocol. Its descriptor is duplicated. For example, I select a sequence starting at 0 msec and ending at 52193 msec. I replay the protocol until 3821 msec. Then I click on the Split button. The sequence qill be split in two, one going from 0 to 3821, the new one going from 3821 to 52193.
►	Merge the currently selected sequence with the next one. Descriptors are added.
2//	<b>Edit the selected sequence label.</b> To change the name/label of a sequence, select this sequence from the list
	(I button to view the list) then click on the <i>Solution</i> . The "descriptor" dialog box will be displayed:
	€ <sub>P</sub> Sequence ∑
	Descriptor
	paragraph 2; word 1; orthography error
	OK Cancel
	Figure 134: Editing a sequence label.
	Edit the label for the sequence (the dialog box is horizontally resizable). Click on
	the "OK" button to validate.
	Alternatively, you may click on the button to select a descriptor in a template (see Template, p.81 for details).
Ü	Delete a sequence. Select a sequence from the list (▼ button to view the list). Once selected, click on the trash button.
•	<b>Scroll down the sequence list</b> . When you click on this icon, the sequences you have defined will be displayed in the form of a drop-down list.
	<u>Important</u> : sequences are sorted according to their date of creation (the most recent one will be at the bottom of the list).
	740083 740303 . ;;       •         501058 502706 alors;;       •         502706 505453 beaucoup;;       •         505453 506377 de;;       •         50927 510796 ;;;       •         510706 614772 pourquoi;;       •         510706 614772 pourquoi;;       •         510706 614772 pourquoi;;       •         516708 61610 g [retour];;       •         516508 61610 g [retoin];;       •         518528 520863 grandes [revision];;       •         522495 524551 de;;       •         522495 525731 de;;       •         525731 526670 si;;       •         522650 52054 oreilles;;       •         523054 532648 ?;;       •         532054 532648 ?;;       •         532054 532648 ?;;       •         532646 534389 grandes [revision];;       •
	Click on a sequence. The protocol will immediately jump to the start time of this sequence.

To manage the list of sequences, you may use the "Tools/Sequences" menu. This menu has

submenus that allows you to open, save, edit and clear a list of sequences.

The sequence list files allows you to manage multiple sets of sequences for a same protocol and to use them as a function of what is intended (different data extractions, for example) or to use the same sequences with different protocols.

Image: Sequences       Ctrl+Z         Resample       Shift layers         Shift layers       Image: Sequences         Image: Sequences       Edit sequence	?	Display ?	Extraction	Tools	Visualisations	Protocol	Device tests	File
Resample       Image: state interview of the sequences         Shift layers       Image: state interview of the sequence interview of the sequen	_î	• •		I+Z	Ctr		Cancel	17
Shift layers Visual zones (AOI) Code -1 "out-of-field" Eye data Correct "out-of-field" erroneous Eye data Build fixations Filter Tab data Build pauses Tablet zone auto-coding Word separation Reset codes Replace codes Aggregate redundant codes	€ ►=	2 🕃	₹≠₄ =₄				Resample	
<ul> <li>Visual zones (AOI)</li> <li>Code -1 "out-of-field" Eye data</li> <li>Correct "out-of-field" erroneous Eye data</li> <li>Build fixations</li> <li>Filter Tab data</li> <li>Build pauses</li> <li>Tablet zone auto-coding</li> <li>Word separation</li> <li>Reset codes</li> <li>Replace codes</li> <li>Aggregate redundant codes</li> <li>Sequences</li> <li>Edit sequence is</li> </ul>							Shift layers	
Code -1 "out-of-field" Eye data         Correct "out-of-field" erroneous Eye data         Build fixations         Filter Tab data         Build pauses         Tablet zone auto-coding         Word separation         Reset codes         Replace codes         Aggregate redundant codes         Sequences         Edit sequence I         Audio sequences						(AOI)	Visual zones	8
<ul> <li>Correct "out-of-field" erroneous Eye data</li> <li>Build fixations</li> <li>Filter Tab data</li> <li>Build pauses</li> <li>Tablet zone auto-coding</li> <li>Word separation</li> <li>Reset codes</li> <li>Replace codes</li> <li>Aggregate redundant codes</li> <li>Sequences</li> <li>Edit sequence is</li> </ul>					ye data	t-of-field" E	Code -1 "out	
<ul> <li>Build fixations</li> <li>Filter Tab data</li> <li>Build pauses</li> <li>Tablet zone auto-coding</li> <li>Word separation</li> <li>Reset codes</li> <li>Replace codes</li> <li>Aggregate redundant codes</li> <li>Sequences</li> <li>Edit sequence in</li> </ul>				a	rroneous Eye dat	-of-field" e	Correct "out-	٩
Filter Tab data       foid, le         Build pauses       foid, le         Tablet zone auto-coding       in Micre : O         Word separation       remonha         Reset codes       ijà vu lu         Replace codes       d'aller         Aggregate redundant codes       nièget         Sequences       Edit sequence li         Audio sequences       Clear sequence						ns	Build fixation	Ф.
Build pauses       Fois, La         Tablet zone auto-coding       Mare - G         Word separation       remonha         Reset codes       ijà vu lu         Replace codes       d'aller         Aggregate redundant codes       pièget         Sequences       Edit sequence li         Audio sequences       Clear sequence			0			ta	Filter Tab dat	
Tablet zone auto-coding       in       Micheir Gi         Word separation       remonha         Reset codes       ijä vv lu         Replace codes       d'aller         Aggregate redundant codes       niéget         Sequences       Edit sequence li         Audio sequences       Clear sequence	per	le y	703,				Build pauses	
Word separation       remonha         Reset codes       ijà vu lu         Replace codes       d'aller         Aggregate redundant codes       pièget         Sequences       Edit sequence li         Audio sequences       Clear sequence	round	re · anol	a Mè		g	auto-codin	Tablet zone a	
Reset codes     ijà vu lu       Replace codes     d'aller       Aggregate redundant codes     niêger       Sequences     Edit sequence li       Audio sequences     Clear sequence	a e	na (e	renion	+		tion	Word separat	
Replace codes     A ' aller       Aggregate redundant codes     Diéger       Sequences     Edit sequence li       Audio sequences     Clear sequence	pert	Le .	cja vu				Reset codes	
Aggregate redundant codes     Die get       Sequences     Edit sequence li       Audio sequences     Clear sequence	che	aller c	Ľ λ'.			es	Replace code	
Sequences Edit sequence li Audio sequences Clear sequence		per en	piès		odes	edundant co	Aggregate re	
Audio sequences Clear sequence	st	quence list	Edit see				Sequences	
riadio sequences	ist <sup>VC</sup>	equence list	Clear s	×		nces	Audio seque	
Open			Open		- in the second	11		_
Save as			Save as	and a				
Le peht cha Export			Export.	cha	e peht			

Figure 135: Sequence management menu.

MENU	DESCRIPTION		
Edit sequence list	Allows to modify the sequences list content: timing and descriptor. See further for details.		
Clear sequence list	To erase the content of the sequence list.		
Open	The "Open" submenu allows you to load (or re-load) a sequence list previously saved in a file. A dialog box helps to select such a file (*.SEQ). Click on the " <i>Open</i> " button to validate and the sequences will be loaded into the sequence list, replacing the existing ones if there was any.		
Save as	Allows you to save the current sequence list in an independent sequence list file (*.SEQ file).		
Export	Allows you to save the sequence list in a "text-only" format file (*.TXT). A dialog box allows to set a name for file.		
	You may thus re-use the sequence list data as you want, for example		

with some other type of software such as a spreadsheet.

N 🔻	Start 👻	End	Description 👻
1	0	3821	;;i);;
2	3821	52195	;;i);;
3	52195	54338	était;;
4	54502	55354	une;;
5	55354	57326	fois;;
6	57326	57494	
7	57494	58254	le;;
8	58254	66261	petit chaperon rouge;;
9	66261	81603	un;;
10	81603	82967	jour;;
11	82967	83259	
12	83259	90574	il;;
13	90574	93297	décida;;
14	93297	94997	de;;
15	94997	97833	[RL] rendre;;
16	97833	99749	visite;;
17	99749	100689	à;;
18	100689	107160	Mère-grand;;
19	107160	117250	en;;
20	117250	119726	passant;;
21	119726	121038	par;;
22	121038	121698	la;;
23	121698	124138	fôret;;
24	124138	124670	-;;;
•			4

To edit the list of sequences, click on the "*Edit sequences list...*" submenu.

Figure 136: Editing the entire sequence list.

The sequence list editor presents 4 columns:

- Descriptor number
- Hour of sequence start
- Hour of sequence end
- Sequence description. Note that in the above example, semi-colon have been used to separate "fields" in the description, thus allowing to dispatch the description into multiple columns in a spreadsheet (like Microsoft Excel or LibreOffice Calc, for example).

Clicking on the **v** button allows to sort the list, based on the column values.

When modifying the list, please make sure you respect the order of elements in a sequence: start time (in milliseconds) is before end time.

When you have finished editing, click on the "*OK*" button to validate the changes.

#### XII.2. Audio sequences

When an audio recording took place while recording tablet and/or eye mouvements data, the audio wave form is displayed, with playback and display management buttons.



Figure 137: A protocol with audio recording.

Additionally, a dedicated sequences management toolbar is shown, next to playback buttons.

► ■ <b>   <del> </del> <del>     </del></b>	+] 📑 📑	0 1357	blank before speech	• 2/	<b>∢ ≻</b> ⊳ ⊲	Ü
	tion the second se				. ·	

Figure 138: Audio sequence toolbar and audio waveform display.

An "*Audio sequences*" menu item become available, in the *Tools* menu. Audio sequences are managed the same way as "usual" sequences.



Figure 139: Audio sequences management menu.

Menu and features are the same (see <u>XII.1. Sequences</u>), except file names extension which are ".ASQ" (stands for **A**udio **S**e**Q**uences).

# XII.3. Successive data with the same code aggregation

(Tools/Aggregate redundant codes menu)

Aggregate redu	ndant codes		×
– Select data t	ype		
TAB	Specific code	0	
V EYE	Specific code	-1	
		ок	Cancel

Figure 140: Select code for aggregation.

This function can be used for deleting, for example, successive Eye data with the code -1 (mainly "out-of-field data").

A dialog box allows you to choose the data type it will apply to: Tab and/or Eye.

If no specific code is set ("specific code" checkbox unchecked), treatment will apply to all codes: two successive data sharing the same code will be aggregated.

The aggregation adds the duration of the erased data to that of the first item of data. The data are thus aggregated "to" the first item of data.

This function must be used with care, as it can be applied to all codes (except o).

# XII.4. Correct "out-of-field" erroneous Eye data

(Tools /Correct "out-of-field" erroneous Eye data menu)

Some eye trackers may return "weird" data when the participant looks outside the calibrated area (e.g. a sight angle of 4068 degrees).

If you do not wish to discard these data (coding them -1), for example to keep the corresponding saccade, you can correct these data by constraining them to a margin around the calibrated area.





This dialog box allows you to define a tolerance margin around the calibrated area (in tablet

units). Data within this margin will not be modified. Only data outside this area will be modified: their coordinates will be replaced using linear interpolation between the last known "good" data (i.e. within the area or margin) and the next good data. If there are no such data (i.e. end of protocol), coordinates will be replaced by the nearest limit of the last "good" data.

# XII.5. Cancel

## (Tools /Cancel menu)

As its name says, this function allows canceling an action. The following actions may be undone:

- Shift layers
- Visual Zones (AOI)
- Code -1 "out-of-field" Eye data
- Correct "out-of-field" erroneous Eye data
- Aggregate redundant codes
- Tablet zones auto-coding
- Replace codes
- Reset codes
- Build fixations
- Filter Tab data
- Build pauses
- Thresholds
- Resample

This function is cumulative (one may undo several successive actions), and the number of undo levels can be set in Eye and Pen configuration (*Configuration/Application* menu).

## XII.6. Zoom

(Display/Zoom menu to show/hide this tool)

If you need to enlarge the whole display for long, use the *Display/Enlarge* menu to double display size (shrinking by a factor 2 is also available).



Figure 142: Increasing display.
A second tool is available, for a more episodic use. It allows you to zoom in on a particular area of the screen.



Figure 143: "Zoom" tool.

To select the zoom factor, click on the  $\checkmark$  icon, then select a zoom factor from the 6 zoom levels (2x, 4x, 6x, 8x 10x, 12x).

Next, click on the magnifying glass to activate the tool (click again to de-activate).

	• 2/	< ► ► <	🔍 4x 💌 🖓 🔘		
€ <sub>P</sub> Zoom					<b></b>
	- 3	001 00	A REFERENCE		
1 <u>1</u> 1	- Chape	Long-	rDuge	ام	or:
	. <b>T</b>		ر .	6-	I
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[[	to be	- <i>*</i> Ui1	a 4	a.h.	
	7-2.7	• -	~~	****	· · ·
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on rouge &	pose alors	beaucoup de	questions.		
ndes dents?	'De si grandu	un somether? E	t surbout, hous		
as le gron	d mechant L	$r = \frac{1}{2} $	en hop pressé		
K Mais a	a rouge allo	ire - Guand as	Mars all (1)		
م منابع		- 1			

Figure 144: Zoom "at work".

Your mouse cursor will indicate the center of the area to be magnified in the Zoom window. This window is resizable and movable.

There are two ways of closing it:

- click on the cross in the upper right-hand corner of the window;
- click on the magnifying glass icon again.

### XII.7. Capture a picture of the analysis

(*Protocol/Capture to picture* menu)

Save							23
) ⊂ 🚺 ト Libra	aries 🕨 Documents 🕨	My Documents 🕨 Ey	/e and Pen 3 🕨 data		<b>- - 4</b>	Search data	,
Organize 🔻 New	/ folder						= • 0
★ Favorites ■ Desktop	Documer     data	nts library				Arrange by:	Folder 🔻
Downloads	Name	^	Date modified	Туре	Size		
Recent Places			No items n	natch vour search.			
🛜 Libraries	=		No items in	laten your search			
Documents							
🁌 Music							
Pictures							
🛃 Videos							
🖳 Computer							
ڏ SYSTEM (C:)							
🚗 Removable Disk	k I						
🖵 numerisation (V	W						
File name:	S401_chien.jpg						
Save as type: F	Picture file (*.jpg)						
Hide Folders						Save	Cancel

Figure 145: Taking a "snapshot" of the analysis.

A dialog box allows you to name the capture. Next, click on the "Save" button to generate a JPEG picture (".jpg" extension) showing the current state of the analysis, without menus or boxes.

### XIII. SAVE ANALYSIS

#### XIII.1. Creating a sub-analysis

(Protocol/Sub-analysis menu)

If only a portion of the protocol interests you, you can create a sub-analysis, in a separate file.

Export a sub-analysis	×
Time range (in milliseconds)	
Start 0 🕃 End 20765	•
Range starts after pause 0	
Export events during pause 0	
ОКСС	ancel

Figure 146: Defining sub-analysis time limits.

A sub-analysis is part of the overall analysis defined by a beginning and an end time (in milliseconds). Select (type in) a time for the beginning and a time for the end. If you wish your selection to start at the end of the pause "zero" (also called pre-writing pause), i.e. when writing starts, tick the checkbox "Range starts after pause o".

<u>Example of use</u>: you want to export the 20 first seconds of writing, whatever the pre-writing pause duration is. Define the range from 0 to 20,000 and tick the checkbox. If you want to export the event occurring during the pre-writing pause as well, tick the second checkbox (enabled only when the range starts at 0).

Then click on the "*OK*" button. A dialog box will allow you to supply a path (directory) and a name for this new file ("*.twk*" and "*.ewk*").

If sequences exist, sequences included in the sub-analysis are also saved. If sequences "cross the border" (sequences starting before the beginning of the sub-analysis or finishing after the end of the sub-analysis), they are discarded (not saved).

If retrospective comments exists within the time range, they will also be exported.

If the protocol includes audio recording, the time range involved will be exported as well. If audio sequences has been defined, they will be exported following the sames principles as for "usual" sequences.

# XIII.2. Saving an analysis

There are two ways of saving data during an analysis:

- Click on the *"File"* menu, then click on *"Save"* to save the protocol under its current name;
- Click on the "*File*" menu, then click on "*Save as*". The following dialog box will then be displayed.

€p Save						EZ
OO - 🚺 🕨 Lib	raries 🕨	Documents  Public Documents	s ▶ Eye and Pen 3 ▶ data		✓ 49 See	nrch data 🔎
Organize 🔻 Nev	v folder					:= 🗸 🔞
🔆 Favorites 📃 Desktop	<b>^</b>	Documents library				Arrange by: Folder 🔻
Downloads		Name	Date modified	Туре	Size	
Recent Places		Copie de S401_chien.twk	06/01/2012 17:22	TWK File	91 KB	
词 Libraries	=	S401_chien.twk	06/01/2012 17:22	TWK File	91 KB	
Documents						
🁌 Music						
Pictures						
Videos						
🖳 Computer						
🏭 SYSTEM (C:)						
🚗 Removable Dis	k (					
🖵 numerisation (	W: -					
File name:	S401_c	hien.twk				<b>•</b>
Save as type:	Eye and	Pen analysis file (*.twk)				<b>•</b>
Alide Folders						Save Cancel

Figure 147: Saving an analysis under a new name.

Give a new name to the file (".twk") and click on the "*Save*" button. A copy of the current protocol will be created with another name.

#### XIV. DATA EXTRACTION

#### XIV.1.Selection of information to extract

First, you define extraction parameters: range of data, specify data details to extract and optional restrictions in the "Extraction / Preferences". You may also define parameters specific to the "Tracing dynamics" and "Visual zones" extractions.



Figure 148: Extraction preference menu.

#### XIV.1.1 Range



Figure 149: Select the range of data to extract.

The "Analysis range" frame allows you to:

- extract data from the whole protocol;
- restrict extraction to (previously defined) sequences.

Under this frame, you'll find 2 options described below:

LABEL	DESCRIPTION
Align data at sequence boundaries	Should I do anything with data beginning before and ending after a sequence? This option can only be activated if " <i>Sequences</i> " (" <i>Analysis range</i> ") is selected.
Add range description to each line	Range description is composed of the sequence number (according to date of creation) the data belongs to, beginning timestamp, ending timestamp and label. If the data being extracted is not inclued in a sequence, its sequence number is " <b>-1</b> " and its name is " <b>NoSeq</b> ".

#### <u>Notes</u>:

- If the option "Add range description" is selected and the data are extracted from the "Whole production", for each event, the first matching sequence found (in the sequence list tool scrolling order, from top to bottom) is selected, even if the event belongs to more than one sequence.
- If some Eye and Tab samples belongs to different sequences (e.g., a fixation begins in a sequence and continue in another sequence where a Tab event occurs), the most recent sequence will be considered.

The options of the "*Method to align data at boundaries*" frame are activated when the "*Align data at sequence boundaries*" option is ticked.

LABEL	DESCRIPTION
None	No events that are "truncated" by a sequence limit will be taken into account.
Linear interpolation	An event that is "truncated" by a sequence boundary will be included in the sequence. A linear interpolation calculation will determine the coordinates corresponding to the "cut-off-" point.
Time-based segmentation	An event that is "truncated" by a sequence limit will be partially included in the sequence. A time-based segmentation will adjust the event time to the sequence start and/or finish.

# XIV.1.2 Data

Parameters selection				×		
Data to output						
	– Tab –		Eye			
Number	<b>V</b>		<b>V</b>			
XY start	<b>V</b>		<b>V</b>			
XY end	<b>V</b>		<b>V</b>			
Distance	<b>V</b>		<b>V</b>			
Pressure	<b>V</b>					
Start time	<b>V</b>		<b>V</b>			
End time	<b>V</b>		<b>V</b>			
Duration	<b>V</b>		<b>V</b>			
Code	<b>V</b>		<b>V</b>			
Categorization	<b>V</b>		<b>V</b>			
Everpen distance	at start					
Lye-periodistance	atond					
- Additional informati	on					
	011					
Add time/distar		rmations				
Add thresholds	Information	IS				
Print column ne	ader	P				
Add participant	Add participant ID to each line					
Parse participant ID in columns						
Separator _						
	OK Cancel					

Figure 150: Select the data to output.

The "*Data to output*" frame allows you to fine-tune the details of the information you wish to extract:

LABEL	DESCRIPTION
Number	Event number in its category (Tab or Eye data) since the beginning of the protocol. The first event is numbered zero.
XY start	Coordinates when the event began.
XY end	Coordinates when the event ended.
Distance	Euclidean distance between start and finish of the event.
Pressure	Pressure of the pen on the tablet.
Start time	Time when the event began.
End time	Time when the event ended.
Duration	Event duration.
Code	Event-associated code.

Categorization	Allows you to add a categorization code to Tab and Eye data. Codes are:		
	<ul> <li><i>Up</i> (pause with pen above the tablet) or <i>Dn</i> (pause with pen pressed) or <i>Mov</i> (movement) for tablet data;</li> <li><i>Fix</i> (fixation) or <i>Mov</i> (movement) for eye tracking data.</li> </ul>		
Eye - pen distance	Euclidean distance between the position of the pen and the position of the "gaze":		
	<ul><li>when the event started</li><li>when the event ended</li></ul>		
	The choice of measurement unit (tablet or metric/imperial unit) is made in the analysis configuration panel, " <i>Analysis</i> " Tab.		

The "*Additional information*" frame allows you to select a label to add to each line of the extracted data:

Add time/distance unit information	Add time unit and distance unit information at the beginning of the extracted data (participant's ID is always added).
Add thresholds information	Threshold values (pauses, fixations) will be at the beginning of the extracted data.
Print Column header	As it is said, column name will be printed on top of each column in the data output file (see appendix VII. Data extraction column headers).
Add participant ID to each line	Add participant's name to each data line in the output file.
Parse participant ID in columns	This option can only be activated if the "Add participant ID to each line" has been selected (ticked). Each separator (character to be typed in the option field) found in the participant identifier name is replaced in the data extraction file with a tabulation character. The first component of the participant identifier is kept in the first column as the participant ID. The other components are placed in additional columns (labeled as <i>Id1</i> , <i>Id2</i> , etc. in the column header). <u>Example:</u> Subject 12 read "Text 2" in the "C1" condition. By naming the acquisition file "Participant12_T2_C1" and choosing the "_"
	("underscore") character, the filename will be parsed into 3 columns containing "Participant12", "T2" and "C1". When you build data matrices (e.g. based on data extracted for several participants), it will thus be far easier to sort data based on participants, groups and experiment conditions.

#### XIV.1.3 Codes

The dialog box allows setting codes (individual code, codes range, or codes list) to restrict extraction to data tagged with these codes.

Parameters selection	
Codes list	
Enter codes separated by "," or "-" for a range	
Tab codes	
0,4-123,127	
Eye codes	
0-127	
[ to select all codes : 0-127 ]	
ОКС	ancel

Figure 151: Define codes to set filter for extraction.

To restrict the data extraction to one or more code(s), type the code number you want in the *"Tab code"* box for the tablet data and in the *"Eye codes"* box for the eye-tracking data.

Separate isolated (individual) codes with a comma "," or with an hyphen "-" if you want to select a range of codes.

For example, figure 151 (above) reads: code zero, then every code between 4 and 123, and code 127.

### XIV.1.4 Tracing dynamics

This dialog box allows you to set the options specific to the extraction of the tracing dynamics (mouvements) data.

Parameters selection	X
Tracing dynamics	
Detail levels	
Sub-blocks between pauses	
Sub-blocks between pauses above the second secon	nreshold
Sub-blocks between coded pauses	
Pairs of points	
Include pauses in calculations	
Eye-Pen distance at start and end of t	block
ОК	Cancel

Figure 152: Tracing dynamics extraction preferences.

The parameters in the "*Detail levels*" frame are described below.

LABEL	DESCRIPTION
Overall	Gives an overall description of the pen tracing dynamics (average speed, etc.)
Sub-blocks between pauses	Pen tracing is broken up into segments, delimited by "up pauses".
Sub-blocks between pauses (above threshold)	Pen tracing is broken up into segments, delimited by "up pauses" with duration longer than the pause threshold.
Sub-blocks between coded pauses	Pen tracing is broken up into segments, delimited by "up pauses" with a significant code (>0).
Pairs of points	Calculations are made for each pair of successive points.

Below this frame (and inside the "Tracing dynamics" frame) you will find two options:

- **"Include pauses in calculations**". If this option is not ticked, calculations of tracing dynamics will not include pause values. They will be based on "pure" movements.
- "Eye-pen distance at start and end of block".

#### <u>Note</u>

For all detail levels, except "Pair of points", the pressure value extracted is a mean value, weighted with each event's duration in the considered segment, to take the possible variations of time intervals between samples into account.

### XIV.1.5 Visual zones (AOI)

This dialog box allows you to set the options specific to eye-tracking data extraction when in a visual zone AOI.



*Figure 153: "Eye" data in visual zone extraction preferences.* 

The following table describes the parameters for the "Visual Zones" frame:

LABEL	DESCRIPTION
Overall data: by zone	Each line contains a summary of all the data for an AOI, in the AOI list order (by AOI number).
Overall data: add	Same as the above option, but if two (or more) zones have the

together zones with same code	same code for data, their data will be added together and they will be regarded as a unique zone. Each line in the file will show the summary for a particular data code belonging to one or more zones.
Serialized data (zone consultation order)	Each line of the output file shows a data summary for an AOI. The order is that of AOI consultations. Each AOI may therefore appear several times. By following the lines of the summary, you can follow the participant's "route" across the AOIs.

# XIV.1.6 General

This dialog box allows you to set the options that are common to all extractions.



Figure 154: Overall data extraction preferences.

The radio buttons lets you set the software behavior if you selected an already existing filename for data extraction: overwrite (replace the old file with a new one) or add the new data to the existing file.

#### XIV.2. Choose the type of events to extract

Data are "published" in tabulation-separated ASCII files (can be imported into most types of statistical software, spreadsheets and word processors).

Select the type of information you want to extract in the "Extraction" menu

alisations Tools Extraction				
	Protocol statistics	ł		
	Events •			
	Pauses			
	During pauses			
	Fixations			
	Visual zones (AOI)			
	In air movements			
	Tracing dynamics <sup>VS</sup>			
ß	Preferences •			

Figure 155: Data extraction menu.

TYPE of EVENT ACTION					
Protocol statistics	Extractions/Protocol statistics				
This is the export of the data Data are set into columns to supplementary information ca	presented in the <i>Protocol/Description</i> menu, <i>Statistics</i> tab. o enable matrix creation from many extractions. Somme an be added (see <i>Extraction/Preferences</i> menu).				
Events flow	Extractions/Events/Events flow menu.				
This menu is only available i channel of data, including aud there is no filtering, neither o sequences) are purely infor- extraction.	f the protocol includes audio recording data. It exports all lio sequences. The extraction is complete, which means that on codes or on sequences boundaries.Sequences (and audio mative (no sub-range of data may be selected) in this				
All data (events)	Extractions/Events/All events menu.				
<b>Note</b> : if the options "Add sequence description" and "Whole production" are selected it is the label of the first sequence (in the sequence tool scrolling order, from top to bottom) to which an event belongs that will be extracted, even if the event in question belongs to more than one sequence. However, if an Eye and Tab event belongs to different sequences (e.g. a fixation begins in one sequence and continues in another sequence where Tab events occur), the most recent sequence will be considered.					
Data during pauses and fixations	<i>Extractions/Events/During pauses &amp; fixations</i> menu.				
This menu allows you to extract pauses that occur while a fixation takes place, and vice- et-versa. <u>Note</u> : There is a strong probability that some event may be noted several time in the extraction, as for example several successive fixations during a single pause. For each fixation entry, the pause values are then repeated.					
Trigger zone use	Extractions/Events /Trigger zones (Simple) menu				
Extracts data recorded when "image" zones are used during a Simple acquisition (relies on the coordinates defined in the <i>File/Configuration/Edit</i> menu, <i>Simple</i> tab).					
(usually marking the end of the pause), the total duration of pen pressure in the zone (may sum several successive presses in the same zone), the Up pause before the pen moves out of the zone and the first press of the pen out of the zone. The start of the pause "before" and the end of the pause "after" may be used as indicators of a "round trip" from text to zone and thence to text. The information that is extracted depends on the tablet data extraction options (number, coordinates, timestamp, code, etc.).					
<u>Note</u> : the inclusion of pauses (an Up pause is a duration with a null pressure) in t pressure calculation will influence its result (see options for "tracing dynamic extraction).					
Pauses	Extractions/Pauses menu.				
Eye (gaze) activity during pausesExtractions/During pauses/Eye Activity menu.					

	Enternational (Density of the second of the				
Fixations during pauses	Extractions/During pauses/Fixations menu.				
Eye activity in AOI, during pauses	<i>Extractions/During pauses/Eye Activity in AOI</i> menu.				
Fixations in AOI, during pauses	<i>Extractions/During pauses/Fixations in AOI</i> menu.				
Summary of all eye movements in AOI, during pauses	<i>Extractions/During pauses/Eye Activity in AOI summary</i> menu.				
Summary of all fixations in AOI during pauses	<i>Extractions/During pauses/Fixations in AOI summary</i> menu.				
Fixations	Extractions/Fixations menu.				
Eye activity in AOI	Extractions/Visual zones (AOI)/Eye activity menu.				
Fixations in AOI	Extractions / Visual zones (AOI) / Fixations menu.				
Eye activity in AOI summary	<i>Extractions/Visual zones (AOI)/ Eye activity summary</i> menu.				
Fixations in AOI summary	Extractions/Visual zones (AOI)/fixation summarymenu.				
AOI scanpath summarized as a string of letters	<i>Extractions / Visual zones (AOI) / Route as string</i> menu				
Extracts the route of fixations through the AOI as a string of letters, each letter corresponding to a zone: A=zone 1, Z=zone 26. Only the first 26 AOIs are taken int account (beyond the "alphabet scope", AOIs are labeled with "?"). You may get something like "GAHGADCDEGEGABGAGEEGAGAGEEGACHGH".					
This sort of data can be used t Levenshtein distance) or to pe	o compute the likelihood of different "routes" (e.g. with the erform pattern matching analyses.				
In Air Movements	Extractions/In Air Movements menu.				
Extracts data from movements when pen is not in contact with the tablet, the same way as for pauses data: x and y coordinates at beginning and end, beginning and end time, summed distance (all samples in a movement), etc.					
Please note that samples numbers (Tab number), may later be modified when buildi Up pauses, because samples may have been deleted during processing. So, if requiring match In Air Mouvements data with Pauses, it is a better practice to rely on timestamps					
Tracing dynamics (pen movement data)	Extractions/Tracing dynamics menu.				
Extracts parameters of pen meetc).	ouvements when writing/drawing (speed, length of trace,				

Lastly, a dialog box allows you to give a name (and optionally a new path) to the text file that is to contain the data.

P All events								23
🔾 🗸 🗸 Lib	raries	<ul> <li>Documents</li> <li>N</li> </ul>	ly Documents 🕨 Eye	and Pen 3 🕨 data		<b>▼</b> <sup>4</sup> 7	Search data	م
Organize 🔻 🛛 Nev	w folde	r					1	≣ ▼ 🕡
★ Favorites ■ Desktop	<b>^</b>	Documents	library				Arrange by:	Folder 🔻
Downloads		Name	^	Date modified	Туре	Size		
Kecent Places				No items n	natch your search.			
🧃 Libraries	Ξ							
Documents								
Music     Dictures								
Videos								
📜 Computer								
🏭 SYSTEM (C:)								
Removable Dis	sk I							
umerisation (	W. *							
File name:	S401_0	:hien.txt						
Save as type:	Text fi	e (*.txt)						•
Hide Folders							Save	Cancel

Figure 156: Naming the output file.

Click on the "Save" button to complete the process.

### XV. DATA EXPORTS

# XV.1. Exporting sample data as a text file

(File/Exports/Text file...menu)

$\epsilon_p$ Export as a text file							23
OO - 📕 🕨 Lit	oraries 🕨	Documents  My Documents	ye and Pen 3 🕨 data		• <b>*</b>	Search data	٩
Organize 🔻 Ne	w folder						!≕ - (2)
<ul> <li>Favorites</li> <li>Desktop</li> </ul>	<b>^</b>	Documents library				Arrange b	y: Folder 🔻
Downloads		Name	Date modified	Туре	Size		
Necent Places			No items n	natch your search.			
4 📷 Libraries	Ξ						
Documents							
🛛 🌙 Music							
Pictures							
🛛 📑 Videos							
🗉 🖳 Computer							
ା 🏜 SYSTEM (C:)							
🛛 👝 Removable Di	isk (						
🛛 🖵 numerisation	(W: 👻						
File name:	S401_c	hien.tab.txt					-
Save as type:	Text file	e (*.tab.txt)					•
Hide Folders						Save	Cancel

Figure 157: Naming the text file.

Select a directory, choose a name for the file, and click on the "Save" button.

Let us suppose that you gave *MyFile* as the filename. In this case, tablet data will be exported to *MyFile.tab.txt* and eye-tracking data to *MyFile.eye.txt*.

Tablet data include time (in milliseconds), X and Y coordinates, and pen pressure.

Eye data include time (in milliseconds) and X and Y coordinates.

### XV.2. Exporting sample data as a Ductus file

(File/Exports/Ductus... menu)

This menu allows to export Tab data into a file suitable to be analysed with the Ductus software (ref. biblio et lien web).

Select a directory, choose a name for the file, then click on the "Save" button.



Figure 158: Naming the Ductus file.

Let us suppose you gave *MyFile* as the filename. Tablet data will therefore be exported to the file named *MyFile.ductus.txt*.

## XV.3. Exporting sample data as a Eye and Pen 2 file

(*File/Exports/Eye and Pen 2...* menu)

This menu allows to export Tab and Eye data into an Eye and Pen 2 compatible format. This tools is devised for backward compatibility with previous version of Eye and Pen.

Export tablet data as Eye	and Pen 2 file						X
🔾 🗢 📕 🕨 Libraries	<ul> <li>Documents &gt; My</li> </ul>	y Documents 🕨 Eye a	nd Pen 3 🕨 data		<b>-  4</b> <del>9</del>	Search data	م
Organize 🔻 New fold	ler						
★ Favorites ► Desktop	Documents <sub>data</sub>	library				Arrange by	Folder 🔻
Downloads	Name	^	Date modified	Туре	Size		
Recent Places			No items m	natch your search.			
🥞 Libraries 🗧							
Documents							
Music     Dictures							
Videos							
🖳 Computer							
🏜 SYSTEM (C:)							
Removable Disk (							
with numerisation (With							
File name: S401	_chien.EP2.tab						•
Save as type: Eye a	nd Pen acquisition file	(*.EP2.tab)					•
Hide Folders					[	Save	Cancel

Figure 159: Naming the Eye and Pen 2 file.

Select a directory, choose a name for the file, and click on the "Save" button.

Let us suppose you gave *MyFile* as the filename. Tablet data will therefore be exported to the files named *MyFile.EP2.tab* and *MyFile.EP2.eye*.

### XV.4. Exporting sample data as a Model file

(File/Exports/Model... menu)

Exports the current analysis into a text file format, suitable for handwriting/drawing replay via the PlayModel script command (see Script reference manual). When selecting this menu, a dialog box allows you to give a name (and optionally a new path) to the text file that is to contain the data.

$\epsilon_p$ Export as Model file							23
COO - 🚺 🕨 Libraries	<ul> <li>Documents I My</li> </ul>	Documents 🕨 Eye and F	Pen 3 ▶ data		• <del>4</del>	Search data	م
Organize 🔻 New folder	r					:	≣ ▾ 🔞
★ Favorites ► Desktop	Documents I <sub>data</sub>	ibrary				Arrange by:	Folder 🔻
Downloads	Name	^	Date modified	Туре	Size		
Recent Places			No items m	natch your search.			
🥃 Libraries 🗧 🗉							
Documents							
J Music							
Pictures							
Videos							
🖳 Computer							
🏭 SYSTEM (C:)							
👝 Removable Disk (							
🖵 numerisation (W 🝸							
File name: S401_c	hien.Model.txt						•
Save as type: Text file	e (*.Model.txt)						•
lide Folders						Save	Cancel

Figure 160: Naming the Model file.

Let us suppose you gave *MyFile* as the filename. Tablet data will therefore be exported to the file named *MyFile.Model.txt*.

A "model" file may be modified, provided it is saved as an ANSI text file (MS-DOS like). For example, in Microsoft Excel, you may save as Text (separator: tabulation) (\*.txt).

The file content is build as follows:

- ☑ Sampling rate, in Hz (correct values are between 10 and 1000) For example: 200.
- ☑ Horizontal and vertical resolution of tablet (typically 1000 or 2000 lines / cm). Example: 2000 2000
- ☑ Coordinates range of the tablet: origin and horizontal and vertical extend. For example: 0 0 45630 22480
- ☑ Samples, made of X coordinate, Y coordinate, Pressure value.

Below is a model file content example:

200			
2000	2000		
0	0	44500	22300
0	0	0	
11667	20524	190	
11682	20548	286	
11699	20575	294	
11718	20606	349	
11737	20639	447	
11757	20674	537	
[ samples	continues	s below	]

### I. KEYBOARD: SHORTCUTS, RECORDER AND AUTOMATION

#### I.1. Menu accelerators and keyboard shortcuts

In Eye and Pen, each menu item has an accelerator, i.e. a letter is underlined in the menu item name that shows which key of the keyboard should be pressed to activate this item. Theses accelerators are visible since the menu has been activated with the help of the keyboard ALT key.

The Eye and Pen menu also handles keyboard shortcuts, i.e; keys combinations that allows you to directly activate a menu item, without any need to open the menu first or scroll down any sub-menu.

KEY(S)	DESCRIPTION
CTRL + N	New analysis
CTRL + O	Open an existing analysis
CTRL + S	Save the current analysis
CTRL + F4	Close the analysis
ALT + F4	Quit Eye and Pen
SHIFT + E	Re-center the analysis "window" to make the eye cursor visible
SHIFT + T	Re-center the analysis "window" to make the pen cursor visible
HOME	Jump to start of protocol
END	Jump to end of protocol
Up arrow	Previous pause
Down arrow	Next pause
Left arrow	Previous data (event)
Right arrow	Next data (event)

Default shortcuts are listed below:

Eye and Pen's menu keyboard shortcuts are customizable. Select the "*Display / Menu shortcuts*" menu.



Figure 161: Setting/unsetting shortcuts for menus.

The left-hand column shows Eye and Pen menus and submenus, and the right-hand column shows available shortcuts.

To associate a shortcut with a menu item, select the menu item in the left-hand column, select the shortcut you want in the right-hand column and click on the Associate button. The shortcut will disappear from the right-hand column and the menu item will be updated in the left-hand column.

To dissociate a shortcut, select the relevant menu in the left-hand column, and click on the Dissociate button. The shortcut will once more be displayed in the right-hand column.

To reset shortcuts to their default values, close Eye and Pen and delete the file named "shortcuts.MSL" in the Eye and Pen configuration directory (see Appendix p.176 for details).

Start Eye and Pen.

#### I.2. Keyboard recorder

(Display / Keyboard recorder menu to display/hide the tool)

The keyboard recorder is intended to record keyboard keys and/or keypress combinations when performing an analysis in Eye and Pen. This recording can later be reused by the EPKeys utility (installed with Eye and Pen under the utilities folder) to replay keypress sequences at will. This makes it possible to automate some of the protocol processing or data extractions and even to repeat the processing of a whole set of protocols.



Figure 162: Keyboard keypress recorder.

To activate or deactivate the recorder, click on the button in the *"Keyboard recorder"* toolbar.



Figure 163: The recorder is switched on

When you stop the recorder, a dialog box will appear and offer to save the list of keypresses in a text file.

Select the destination folder, give the file a name and click on the "Save" button.

Save keypresse	s into a text file						? 🗙
Save in:	🕒 Mes documents		•	+	🔁 🖻		
Mes documents récents Bureau Mes documents Poste de travail	CDBurnerXP Project Ductus DUDFab Eye and Pen 2 Mas musique Mes fichiers recus Mes notes Mes vidéos Mon bloc-notes Mon coffre My Experiments My HelpAndManual MySetups RAD Studio	s Projects	<mark>ि</mark> Visual Studio 2005 <b>O</b> Visual Studio Proje 📳 IP.txt	ects			
Savoris réseau	File name:					•	Save
	Save as type:	Text file	e (*.TXT)			•	Cancel

Figure 164: Saving keypresses in a text file.

The text file will contain all the keys or keypress combinations while in the Eye and Pen analysis mode, with one key (or combination of keys) per line.

Key combinations and "special" keys are written between braces (e.g. ALT+f is written as  $\{ALT+f\}$ , and the escape key is represented by  $\{ESC\}$ ).

The file can then be used within the EPKeys utility.

<u>Note</u>: shortcuts and accelerators (letters underlined in a menu item name indicating which key to press to activate the item) are not systematically the same in the French and English versions of Eye and Pen.

#### II. CUSTOMIZING YOUR WORKSPACE

When performing an analysis in Eye and Pen, the environment in which you work can be modified to suit your needs or to be more comfortable. This environment is saved and reloaded with Eye and Pen.

#### II. 1. Move toolbars.

Click (mouse left button) on the handle (sort of vertical line) to the left of the chosen toolbar and drag it to where you want it to be. You can even drag it under the last toolbar (at the bottom), as shown below. The toolbar "docking station" can enlarge itself (add a line at the bottom).



Figure 165: Dragging a toolbar.

Release the mouse left button when the desired location has been reached.



Figure 166: Toolbar moved.

### II. 2. Make toolbars "float".

Click (mouse left button) on the handle to the left of the chosen toolbar and drag it toward the bottom of the screen. Do not release the button until the toolbar has been "extracted" from the toolbar dock.



Figure 167: Undocking a toolbar.

The toolbar will now be inserted into a new window.

Séquences	
▶ ▶ 0 → 360000 ▷	- 20 iii

Figure 168: A floating toolbar.

You can move this window wherever you like in the screen.

Then again, if you want to "dock" the toolbar, just drag it back to the toolbar "docking station".



Figure 169: Docking a toolbar.

### II. 3. Show / hide toolbars.

You can show or hide toolbars using the *Display* | *Toolbars* menu. Click on a toolbar name to show it if it is hidden, or to hide it if it is visible. A visible toolbar has a "Check" mark in front of its name in the menu.

# II. 4. Customize toolbars.

You can customize toolbars using the *Display* | *Toolbars* | *Customize* menu.

$\epsilon_p$ Customize toolbars		
Toolbars  Clock Cl	Buttons          Image: Second system         Image: Second system	
	Ok	Cancel

Figure 170: Toolbar customization panel.

The list to the left shows the available toolbars. Check or uncheck the checkbox in front to show or hide the toolbar.

To select a toolbar without modifying its visibility, click on its name. Then, the right-sided list will be updated to show the buttons and tools located on this toolbar. Like for the left-side list, the checkbox reflects visibility of the buttons/tools. Checked (ticked) means the button is

visible. To modify this, check or uncheck the checkbox.

Click on the "OK" button to apply all changes or on the "Cancel" button to discard changes.

**Hint**: when playing a lot with customization, some toolbar resizing trouble may happen (toolbar looks weird). Undocking and docking again the toolbar refreshes its look.

### II. 5. Resize the "palette".

First of all, the palette can be virtually hidden if you double-click on its title bar.

Tab P 9	<b>V</b> e			
<b>x</b> 0	0	->	Tab	Eye
<b>Y</b> 0	0	_>		
D 19321	82476			
N 0	0			

Figure 171: Shrinking the tool.

Double-clicking again reverses the process.

Next, you can resize the list of codes.

Just click and drag the palette's lower edge (border), either up to shrink the list, or down to enlarge it.



Figure 172: Resizing the code list.

You may also prefer to hide the whole list. This is easy: just click on the "minus" button. The button will then become a "plus". Simply click on it again to show the list.



Figure 173: Hiding the code list.

# **III. MODIFY DISPLAY RATIO**

Using the *Display* menu you can either enlarge or shrink the protocol display size. Clicking on the *Display* | *Enlarge* menu doubles the size of the protocol on the screen. The *Shrink* submenu does the opposite.

Remember that enlarging the protocol size requires additional video memory, so trying to enlarge too much may cause display problems (restarting Eye and Pen solves the problem).

Also remember that some of the Preview functions use pixel sizes as a reference (e.g. for fovea size projection on display calculation). You may therefore need to recalculate fovea size to adapt the preview to this new display ratio (*Configuration* | *Preview* menu).

### IV. UNIT CONVERSIONS

### IV. 1. Angle - pixels

(? / Conversions/ Angle -> Pixels menu)

This dialog box helps to convert, for example, visual angles into screen pixels.

$\epsilon_{p}$ Calculate			X
Angle -> pixels Distance from eye to screen (cm) Display width (cm) Horizontal display resolution (pixels) Angle (degrees)	30,4 33,5 1920 🕞 2,1	->	Pixels 64
		ОК	Cancel

Figure 174: Angle (degrees) to pixels conversion.

Fill the boxes with the requested values and click on the "-----" button.

Value in pixels is displayed in the right side "Pixels" field of the dialog box.

#### IV. 2. Tablet units - distance

(? / Conversions/ Tablet units <->distance menu)

The "Eye and Pen" software has a tool to help you *convert* tablet units (lines) into distance measurement units (centimeters or inches, according to the tablet version). The following dialog box is displayed.

$\epsilon_p$ Conversions		
- Tablet units <-> distance		
Tablet units (lines)		centimeter
500 🚔	<b>-&gt;</b>	2,5
420	<-	2,1
		OK Cancel

Figure 175: Tool to convert Tab units to distance units.

**To convert to distance units** (e.g. into millimeters), type your value in the "*Tablet units*" box, then click on the right arrow "

The value in measurement units is updated in the box to the right (in this case, the "*centimeters*" box).

**To convert to lines**, type the value in the box on the right of the dialog box (bottom line), then click on the left arrow "\_\_\_\_" button.

The value will be updated in the box on the left.

#### IV. 3. Tablet units – pixels

(? / Conversions/ Tablet units <->pixels menu)

$\epsilon_p$ Calculate		
Tablet units <-> pixels		
Tablet units (lines)		Pixels
500	->	71
7	<-	1
		OK Cancel

Figure 176: Tablet units to pixels conversion.

**To convert to pixels**, type your value in the "*Tablet units*" box, then click on the right arrow " button. The value in measurement units is updated in the box to the right (in this case, the "*centimeters*" box).

**To convert to lines**, type the value in the box on the right of the dialog box (bottom line), then click on the left arrow "\_\_\_\_" button. The value will be updated in the box on the left.

#### V. SYSTEM INFORMATION

(?/System information menu)

$\epsilon_p$ System inform	nations 🛛 🕅
Per	version 3.0.0-5 © CNRS, 2004-2018
System Processor Free RAM Free disk space Video card Video chipset <u>2 Screen(s)</u>	Windows 7 Professional Service Pack 1 Intel(R) Core(TM)2 Duo CPU E8500 @ 3.16GHz (3,16 GHz) 57 % (1177 / 2049 Mb) C: 26 % (60844 Mb) ATI Radeon HD 4600 Series - 1024 Mb ATI Radeon HD 4600 Series - 1024 Mb ATI display adapter (0x9498) - Internal DAC(400MHz) DISPLAY1: Dell P2214H(DisplayPort) ▼
Current folder	C:\Users\chesnet\Documents\DTVP3\data\Sub1\
Tablet Eyetracker Audio	1 - WACOM Tablet Eyelink on Ethernet Mixage stéréo (Realtek High Def
	ОК

Figure 177: System information dialog box.

A click on the "Screen" link opens the Display feature of the Windows control panel.

#### VI. LEGAL INFORMATION AND ACKNOWLEDGEMENTS (?/About menu)



Figure 178: Information and acknowledgements dialog box.

The "http" links in the text can be clicked. They open the Internet site mentioned (as far as you have a working Internet connection). If you click on the "Eye and Pen" picture, you'll get to the <u>http://www.eyeandpen.net</u> web site.

# CHAPTER 5: appendices

#### I. NETSYNC WITHIN A WI-FI NETWORK

Here we present a configuration we used for a word copy task, managed in a group. NetSync was used to perform the data collection for the experiment with a group of 5 participants.

Only general information is given below, and the specific implementation may vary according to the systems and devices that are used (refer to their own documentation).

The system comprised:

- 5 laptop computers (clients), each with a tablet, an internal Wi-Fi adapter and an Eye and Pen installed;
- 1 laptop computer equipped with an internal Wi-Fi adapter, an external hard disk (to receive the clients' data) and Eye and Pen software;
- 1 Wi-Fi 802.11n router (300 Mb/s).

The main advantage of this configuration lies in his "mobility": it can be operated almost anywhere, including schools, because it is easy to set up and dismantle.



Figure 179: NetSync within a Wi-Fi network.

# I.1 Wi-Fi router configuration

In order to block undesirable connections, the Wi-Fi router is configured as a semi-static DHCP: the IP address list is entered "by hand" in the router Web interface. Each of these addresses is subsequently allocated to a particular host (clients or master). The MAC address of the host's Wi-Fi adapter is added to each IP address.

The filtering is then activated on the router: only the hosts whose MAC address has been entered in the DHCP can connect to the network.

Thus, no hosts other than client and master hosts can join our "private" network.

# I.2 Host configuration (clients and master)

The Wi-Fi alone is activated and all other communication devices should be deactivated (Ethernet, Bluetooth, etc.).

The host's IP address is set to a dynamic address (DHCP). Its machine name is the same as the one that has been typed in the Wi-Fi router DHCP configuration.

Hosts are configured to automatically connect to our network and no other (this can be stipulated in the Wi-Fi adapter configuration, see Network connections in Windows).

# I.3 Script

Only small changes need to be made to scripts.

The following sequence (added at the beginning of the script) makes the participant wait for the session to start:

```
DisplayMsg(Wait for the session to start...,-1,-1,-1,FALSE)
WaitForNetSync
HideMessage
```

Some other specific commands (see Netsync commands in Script reference manual) can either be inserted into strategic locations in a script, such as pause between blocks of items, or wait until all the participants have finished their trial to start a new one.

### II. CONFIGURING THE TABLET WITH A DOUBLE SCREEN

A double screen configuration is a display configuration (defined in Windows) where you work with a computer monitor <u>and</u> an LCD tablet.

With this kind of configuration, the Windows operating system will consider that the tablet screen and the computer screen are merged into single desktop.

To avoid having the tablet coordinates mapped to both screens, check in your tablet's configuration panel that the tablet is mapped to the correct monitor (not the whole desktop).

#### III. ACQUISITION SESSION LOG FILE

A file is generated for each acquisition session (*<Data Directory><ParticipantID>*.LOG). This contains a trace of the main events of interaction with the participant (displays, recordings, participant's answers, etc.), with the corresponding time (in milliseconds) of the event. The start of timing (the zero hour) coincides with the beginning of the acquisition session (when the "Go" button is pressed).

Each line in the LOG file begins with *<Time>* followed by the command and it's parameters. In the following example list, the parameters between *<>* are replaced (in a true log file) with their value. Please, see "script commands" in the Script reference manual for full names and parameter values).

WaitForTabZoneAt <X1> <Y1> <X2> <Y2> <CanDraw> <MustLeave>

WaitForTabZones < CanDraw> < MustLeave>

ZoneSelected <selected zone label>

Pictures shown and hidden during Rec\_Standard (trigger zones) are recorded in LOG:

- Show Image<numero>
- Hide Image<Numero>

OpenRec <participant file>

CloseRec DisplayMsg <*Message*> <*X*> <*Y*> MessageHidden DisplayText < TextFileName> TextHidden DisplayPic <*PictureFileName*> <*X*> <*Y*> PictureHidden DisplayImageList <ListFileName> <X> <Y> <DurationPerPicture> DisplayAVI <VideoFileName> <X> <Y> AVIEnd WaitForKeyPress KeyPressed <touché appuyée> WaitFor < Durée > PlaySound <WavFfileName> <Wait> SoundEnd WaitForNetSync SendMessageToNetSync < message> TabletMasking <TabMaskFile> <TabMaskMode> <ModeParam>

TabletTimeShift <*Delay*>

#### IV. MENUS TREE VIEW

File	Script editor Acquisition	۲	Sim Scri Net	iple ipt Sync	
	Open Session Save Save as				
	Exports	•	Tex Duc Eye Moc	tt file ctus e and Pen 2 del	
	Close Configuration	•	Edit Ope Sav Sav Relo	t en /e as /e as default oad defaults	
	Quit				
Device tests	Tablet		►	Visual	
	Eye tracker		►	Visual	
	Audio Network messag I/O	ing		Performance	
Protocol	Thresholds History Description Make a sub-ana Capture to pictu	lysis ire	5		
Visualisations	Circles		•	Pauses Fixations	
	Color		Þ	Pauses Pauses by duration classes Fixations	
	Graphs		►	Gaze-pen distance Overlaid Side-by-side	
	Remove visualisa	atior	า		
Tools	Cancel Resample Shilft layers Visual zones (AC Code -1 "out-of- Correct "out-of-f Build fixations Filter Tab data Build pauses	)I) field īeld	l" Ey " err	ve data oneous Eye data	
	Word separatio	o-cc on	Jung	J	
				New Continuer Open Save as	
	Reset codes Replace codes				

	Aggregate redundant Sequences	t code	s 🕨	Edit sequence list Clear sequence list
	Audio sequences		•	Open Save as Edit sequence list Clear sequence list Open Save as Export Export
Extraction	Protocol statistics Events	•	Events flow All events During pauses & f Trigger zones (Sir	ixations nple)
	Pauses During pauses	•	Eye activity Fixations Eye activity in AOI Fixations in AOI Eye activity in AOI Fixations in AOI so	I I summary ummary
	Fixations Visual zones (AOI)	) ►	Eye activity Fixations Eye activity summ Fixations summar Route as string	nary Y
	In air movements Tracing dynamics <b>Preferences</b>	•	General Range Data Codes Tracing dynamics Visual zones (AOI	)
Display	Toolbars •	Clock Seque Retro Zoom Keybe Event Pause Fixati Eye c Tab c Eye-T	ences spective oard recorder s es ons odes odes Tab distance	
	Information Enlarge (x2) Shrink (/2) Menu shortcuts Refresh	Custo	imize	
?	Help index Manual System informations Conversions About	•	Angle -> pixels Tablet units <-> d Tablet units <-> p	istance ixels

#### V. FILENAME EXTENSIONS

This table explains the file extensions recognized or generated by Eye and Pen.

Extension	Meaning
AOI	Visual Area Of Interest file
ASQ	Audio SeQuence file
BMP	Bitmap picture (import / export)
EMF	Image Enhanced Metafile Format (importation)
EWK	Eye data WorK file: analysis file of eye (gaze) data
EXT	"EXTernal" input port acquisition data (e.g. parallel port)
EYE	"EYE tracker" acquisition data
GIF	Image Graphics Interchange Format (importation)
HST	HiSTory file for a protocol (record of data reduction, etc.)
ICO	Icon picture (import)
INI	Eye and Pen configuration file
JPG/JPEG	Jpeg picture(import / export)
LOG	Record of main interactive events during an acquisition session (Script)
MyLOG	User defined log file, used during an acquisition session (Script)
RTR	ReTRospective comments file for a protocol
SEQ	Protocol SEQuence file
TAB	"TABlet" acquisition data
TWK	Tab data WorK file: analysis file of tablet data
TXT	Text file (export)
WAV	Audio file (Wave format)
WDS	WorDS separation data for a protocol
WMF	Windows Metafile Format picture (import)
XML	Description Template file for protocol sequences and audio sequences
	EXPORT FILES
EYE.TXT	"Raw" eye data export file (text-only file)
DUCTUS.TXT	Mouvement data (tab) export file (text only file) to be imported into Ductus software
MODEL.TXT	Mouvement data (tab) export file (text only file), that can be displayed by script.
EP2.TAB	Tab data export for Eye and Pen v.2
TAB.TXT	"Raw" tablet data export file (text-only file)

### VI. FREQUENTLY ASKED QUESTIONS (FAQ)

### VI.1. Calculate a picture's position on screen

If your picture should be placed at the upper left border of the screen that's easy: coordinates are 0 and 0 (the origin of the screen frame is top and left).

To set a picture at 10cm from the left side of the window on a 1024x768 pixels screen resolution (to know the screen resolution, see the Windows control panel, Display, Parameters): I will measure (with a ruler) the display surface's horizontal width. My15 inches LCD screen measures 30,4 cm. My horizontal resolution is 1024, so 10 cm will represent:  $(1024 / 30,4) \times 10 = 336,84$ , i.e.about 337 pixels. I proceed the same way for the vertical coordinate, and that's the trick !

# VI.2. Where are ey and Pen configuration files ?

In a default installation, Eye and Pen configuration files (EP.ini, Shortcuts.msl, etc.) are located into C:\Users\<**YourUserName**>\AppData\Local\Eye and Pen 3. This is a hidden folder.

					- 0	23
Computer ► SYSTEM	(C:) ► Users ► localadmin ► AppData ►	Local 🕨 Eye and Pen 3	✓ ✓ Search I	Eye and Pen 3		P
Organize 🔻 Include in library 🔻	Share with 🔻 🛛 Burn 🔹 New folder				•	?
★ Favorites	Name	Date modified	Туре	Size		
💻 Desktop	ASL504.conf	24/12/2010 16:55	CONF File	1 KB		
\rm Downloads	📰 EP.ini	04/01/2018 09:53	Configuration sett	6 KB		
🕮 Recent Places	EPconfig.default	19/09/2017 17:41	DEFAULT File	6 KB		
=	EPFiles.lst	04/01/2018 11:16	LST File	1 KB		
🛜 Libraries	EPkeys.ini	24/12/2010 16:55	Configuration sett	1 KB		
Documents	EPToolBars.conf	04/01/2018 11:16	CONF File	1 KB		
🌙 Music	EPToolbars.default	25/06/2014 14:04	DEFAULT File	1 KB		
E Pictures	eyelink2.conf	24/12/2010 16:55	CONF File	1 KB		
💾 Videos	eyeputer.conf	24/12/2010 16:55	CONF File	1 KB		
	iViewXHED.conf	24/12/2010 16:55	CONF File	1 KB		
🖳 Computer	ast.lst	04/01/2018 09:53	LST File	1 KB		
SYSTEM (C:)	ScriptEdit.lst	20/09/2017 15:31	LST File	1 KB		
C						
12 items						

Figure 180: Eye and Pen configuration folder.

# VI.3. Other matters

You'll find this list (frequently updated) on the web site <u>http://www.eyeandpen.net</u>, in the FAQ section.

# VII. DATA EXTRACTION COLUMN HEADERS

The following listing explains what each column header means when extracting data from an analysis.

Num_T	Tablet event number (Tab) <sup>4</sup> .
Xbeg_T	Horizontal coordinate at the beginning of the event
Ybeg_T	Vertical coordinate at the beginning of the event
Xend_T	Horizontal coordinate at the end of the event
Yend_T	Vertical coordinate at the end of the event
Dist_T	Distance between the beginning and end of the event
Press	Pressure exerted on the pen tip
Tbeg_T	Timestamp for the beginning of the tablet event
Tend_T	Timestamp for the end of the tablet event
Dur_T	Tablet event duration
Code_T	Code assigned to the tablet event

<sup>4</sup> Tablet and eyetracking data have their own distinct numbering.

Cat_T	Categorization of the tablet event: Up: pause with the pen lifted up Dn: pause with the pen pressed on the tablet Moy: pen movement	
Num E	• Mov: pell movement Evetracking data event number (Eve)	
Xhea F	Horizontal coordinate at the beginning of the event	
Yhea E	Vertical coordinate at the beginning of the event	
Yend F	Horizontal coordinate at the and of the event	
Yend F	Vertical coordinate at the end of the event	
Dist F	Distance between the beginning and end of the event	
Thea F	Timestamp for the beginning of the evetracking data event	
Tend F	Timestamp for the end of the event	
Dur F	Event duration	
Code E	Code assigned to the Eve event	
Cat E	Categorization of the event:	
out_L	• Fix: fixation	
	<ul> <li>Mov: eye movement</li> </ul>	
Dist_T_E_beg	Distance between pen location and gaze location at the beginning of the event	
Dist_T_E_end	Distance between pen location and gaze location at the end of the event	
Sequences		
SeqNum	Sequence number	
Begin	Sequence start time	
End	Sequence end time	
Label	Sequence label (description)	
Trigger zones (Simple acquisition)		
TriggerNum	Trigger zone number	
"Up" pause before the pen is pressed in the zone for the first time		
PrevUpNum	Pause number (tablet event)	
PrevUpXBeg	Horizontal coordinate at the beginning of the pause	
PrevUpYBeg	Vertical coordinate at the beginning of the pause	
PrevUpXEnd	Horizontal coordinate at the end of the pause	
PrevUpYEnd	Vertical coordinate at the end of the pause	
PrevUpXYDist	Distance between the beginning and end of the pause	
PrevUpStartTime	Timestamp for the beginning of the pause	
PrevUpEndTime	Timestamp for the end of the pause	
PrevUpDuration	Pause duration	
PrevUpCode	Code assigned to the pause event	
1 <sup>st</sup> event (sample) when the pen is pressed in the zone		
NumBeg_T	First tablet event number (Tab)	
XBeg_T	Horizontal coordinate of the event	
YBeg_T	Vertical coordinate of the event	
Tbeg_T	Timestamp of the event	
CodeBeg_T	Code assigned to the event	
EffectPressDur	Actual duration of the pen press in the zone (excluding "pen up" durations between two successive presses in the zone), before the pen leaves the zone (pressed somewhere else outside)	

	Last event before the pen leaves the trigger zone			
	NumEnd_T	Last tablet event number (Tab)		
	XEnd_T	Horizontal coordinate of the event		
	YEnd_T	Vertical coordinate of the event		
	Tend_T	Timestamp of the event		
	CodeEnd_T	Code assigned to the event		
	"Up" pause following	g the last press of the pen in the zone (ending up outside the zone)		
	LastUpNum	Pause number (tablet event)		
	LastUpXBeg	Horizontal coordinate at the beginning of the pause		
	LastUpYBeg	Vertical coordinate at the beginning of the pause		
	LastUpXEnd	Horizontal coordinate at the end of the pause		
	LastUpYEnd	Vertical coordinate at the end of the pause		
	LastUpXYDist	Distance between the beginning and end of the pause		
	LastUpStartTime	Timestamp for the beginning of the pause		
	LastUpEndTime	Timestamp for the end of the pause		
	LastUpDuration	Pause duration		
	LastUpCode	Code assigned to the pause event		
Tracing dynamics				
	d_TE_beg	Distance between pen location and gaze location at the beginning of the segment		
	d TE end	Distance between pen location and gaze location at the end of the event		
	nb_pts	Number of tracing (writing) points (events) included in the segment. "Pen down" pauses are included, since not moving the pen is part of the tracing as well.		
	distance	Summed distance between these points		
	duration	Summed duration between these points (including "down" pauses duration)		
	speed	Mean tracing (writing) speed for the segment		
	Pressure	Mean pressure for the segment		
	nb_Excl_pauses	Number of Up pauses ("pen lifts") excluded from calculations		
	Excl_pauses_dist	Summed distance (between pen "Up" and pen "Down") between pauses excluded from calculations		
	Excl_pauses_dur	Summed duration of "up" pauses ("pen lifts") excluded from calculations		
	Visual zones (AOIs)			
	nEvtTab	Number of the tablet event (during a pause)		
	Code T	Code assigned to the tablet event		
	zone	Zone number		
	Code	Code assigned to the zone		
	Tbeg	Timestamp for the beginning		
	nb_pts	Number of eye events in the zone		
	distance	Length of gaze movements in the zone		
	duration	Duration of fixations within the zone		
	speed	Mean speed of gaze movements		

# VIII. STRUCTURE OF "EYE AND PEN" FILES

Every file fulfilling these prescriptions can be opened within Eye and Pen 3. The prototypes are given in Pascal 32 bits. "Word" represents a 16-bit unsigned numeric type, Integer represents a 32-bit signed numeric type.

Field	Туре	Description	
TAB FILE HEADER: (128 bytes)			
Id	Word = 137	TAB file identifier	
Version	Word = 113	Current version	
HeaderSize	Word	Header size (in bytes)	
Dx, Dy	Word	Display X and Y sizes (e.g. 1024*768)	
X1, Y1, X2, Y2	Word	Definition of the tablet coordinates	
LgmmX, LgmmY	Word	X and Y tablet resolution (e.g. 200 lines /mm)	
SamplingRate	Word	Acquisition frequency (e.g. 200 Hz).	
CartesianOrigin	Word	(0/1). Is the coordinates system following a Cartesian orientation? $(1=yes)$	
DecX, DecY	Integer	Data shift	
MeasureUnit	Word	<pre>Measurement unit code:</pre>	
PressureLevels	Word	Pressure levels range	
Reserved	Array[044] of Word	Reserved for future use	

### TAB DATA

Pressure	Integer	Pen pressure (0 to 1023)
Х, Ү	Integer	Pen X and Y coordinates
Time	Integer	Time in milliseconds

# EYE FILE HEADER (128 bytes)

Id	Word = 149	EYE file identifier
Version	Word = 112	Current version
HeaderSize	Word	Header size (in bytes)
OcModel	Word	<pre>Eye tracker model number code:     O: EyePuter     I: EyeLink     2: ASL504     3: iViewX     4 : Tablet tracking</pre>
EyeDegX, eyeDegY	Word	For angular data, number of degrees between two calibration points, on X and Y axes
nPtX, nPtY	Word	For angular data, number of X and Y calibration points
X1,Y1,X2,Y2	Word	Calibration coordinate system for non-angular data (e.g. 0,0,1024,768)

SamplingRate	Word	Acquisition frequency (e.g. 500 Hz)
CartesianOrigin	Word	(0/1). Is the coordinate system following a Cartesian orientation? (1=yes). Fixed to 1, yet
DecX, DecY	Integer	Data shift
Reserved	Array[045] of Word	Reserved for future use

#### EYE DATA

Х, Ү	Integer	X and Y coordinates
Time	Integer	Time in milliseconds

# IX. REGISTRY KEYS (WINDOWS)

When you tick the option "associate Eye & Pen with .TAB and .TWK files", registry keys are added to the Windows registry. These are removed when you untick the option.

Key: hkey_classes_root	Value (Reg_SZ)
\.tab	Ep.Data
\.twk	Ep.Analysis
\EP.Data	EP File
\EP.FileType\DefaultIcon	c:\ Program Files\Eye and Pen 3\ EP.exe,0
\EP.FileType\Shell\open\command	"c:\ Program Files\Eye and Pen 3\ EP.exe" "-F" `%1"
\EP.Analysis	EP File
\EP.FileType\DefaultIcon	c:\ Program Files\Eye and Pen 3\ EP.exe,0
\EP.FileType\Shell\open\command	"c:\ Program Files\Eye and Pen 3\ EP.exe" "-F" "%1"

# X. TROUBLESHOOTING

### 1- Since I plugged a second tablet in, everything has gone wrong.

WACOM tablet drivers prior to version 4.78.6 may cause problems if too many tablets are connected.

De-install the current driver (in Windows, Configuration panel, Add/Remove programs), then install the latest version.

# 2- Eye and Pen tells me "Wintab32.dll not found", but my tablet still seems to work in Windows.

Wintab32.dll is an interface library that is needed for Eye and Pen to communicate with your tablet's driver.

Usually, this file is installed when you install the tablet's software provided by its manufacturer. When in doubt, reinstall the driver.

# 3- I move the pen on the tablet (*Device Test/Tablet/Visual menus*), but nothing happens...

Check if the pen you are using is compatible with the tablet. For example, Wacom Intuos2 pencils are not compatible with other tablets from the same manufacturer. Also check if the tablet's driver is correctly installed and configured. Check if you have selected the tablet you actually want to use (*File/Configuration/Edit* menu, *Tablet* tab)
## 4- When I click on the ?/Manual menu nothing is displayed

Either the EPManuel\_EN.pdf file is not in the *Documents* subdirectory of Eye and Pen, or you do not own the software required to read this document (Adobe Reader®), which you can download for free from the Website http://www.adobe.fr/products/acrobat/)

# XI. ERROR MESSAGES

# <u>General</u>

```
<filename>: analysis data not found
Does the analysis file still exist in the same directory?
```

#### Save failed for <filename>

Is there enough memory left? Does the same filename exist in this directory with a "read-only" attribute?

<filename>: failed to write Idem as above

<filename>: data not found One of the two analysis files is missing (TWK or EWK).

#### not enough video memory

The video card does not have enough video memory capacity to handle the display with the width and height you asked for.

# configuration

```
Configuration file not found: <filename>
The configuration file declared in Eye and Pen is missing
```

#### The program must abort because of a missing file.

A file required by Eye and Pen is not foundt. Check your installation

#### Invalid picture file

The selected picture could not be read by Eye and Pen.

Recording devices already in use

You are attempting to use the tablet when it is already being used.

Save failed for <filename>

Either the file is in "read-only" format or your disk is full.

```
Incorrect numeric value! (e.g. 4,7)
```

You typed something that is not a valid numerical value.

```
Incorrect values in <configuration filename>
```

Some mandatory parameters of the configuration file either do not exist or their value is not a number.

# <u>Script</u>

Cannot load <picture filename>

A picture could not be loaded. Either the name is incorrect (the file cannot be found

where it is supposed to be) or there is not enough video memory available for a picture of this size.

## Error line <number> in script <script filename>

The script contains a mistake. The line number reported does not include empty or comment lines.

#### Duplicate Label: "<label>"

You have created the same label twice, which is not allowed in a script.

#### Unknown command: "<command>"

This command is not known to Eye and Pen. See the command list (maybe a misspelling?).

### Error in file list <list name>

A picture mentioned in the picture list cannot be found.

#### No Wintab32 tablet driver available. Abort recording.

Eye and Pen could not find the tablet driver (see <u>IX. Troubleshooting</u>).

No tablet connected. Abort recording. A tablet is required...

# Label not found: "<label>"

A command refers to a label which does not exist in the script.

#### Cannot find <directory or file>

The script mentions a directory or a file that Eye and Pen cannot find. Typo?

#### Failed to create folder

The NetSync client couldn't create the sub-folder for the acquisition data: is the support full or write locked ?

This message also exists for the Master host.

### Authentication failed

The connection between the Master and the NetSync client failed: the client is not recognized as valid.

#### No audio device detected

Is your PC equipped with a sound card or onboard sound chip? Is it properly installed and configured in Windows?

# Failed to handle audio mixer

Eye and Pen cannot communicate with the audio device management system.

# Audio mixer open failed

Ditto.

#### No MCI device opened

Probably two successive PlaySound commands. The system needs a little time to close the audio device before being able to re-open it with another file. Instead of several successive audio files, it is advisable to create a single file containing all these successive samples (e.g. create a dictated number series).

# <u>Eyelink</u>

#### Eyelink connection lost

A communication breakdown has occurred. Check the Ethernet link.

#### Can't unload Eyelink library

When closing communication with the eye tracker, Eye and Pen unloads a specific Eyelink library. To avoid problems, it is best to restart your computer.

Failed to close EyeLink connection

Eye and Pen could not politely close its conversation with the eye tracker.

ERROR: Start recording failed!

Eyelink failed to start the data recording and data transmission to Eye and Pen.

#### ERROR: Eyelink is not connected!

Check connections and the eye tracker network configuration in Windows.

#### ERROR: No link data samples received!

A communication problem with the eye tracker. Check the configuration on the Eyelink host. Has the recording mode been engaged?

#### EYELINK\_EXPTKIT20.DLL not loaded

The interface library for the eye tracker could not be loaded.

EYELINK\_EXPTKIT20.DLL: function "<*something*>" not supported Eye and Pen requested a function that is not supported by the eye tracker interface library. Have you installed the latest Eyelink library version?

# FATAL: Eyelink "open connection" failed.

Eye and Pen cannot start to "speak" with the eye tracker. Possibly a library version problem.

Cannot get window to calibrate Probably a system overload problem. It is safe to restart your computer.

#### Cannot know which eye is used

Eyelink has returned an incorrect item of information.

## <u>ASL 504</u>

#### Failed to get state: <COM port>

Eye and Pen cannot check the state of the *COM port*> serial port through which it is supposed to communicate with the eye tracker. It is safe to restart your computer.

```
Failed to get timeouts for <COM port>
```

Eye and Pen could not read the timeouts values for the serial port. It is safe to restart your computer.

Failed to set <COM port>

Eye and Pen could not set the parameters for the <COMport> serial port. It is safe to restart your computer.

#### Failed to set timeouts for <COM port>

Eye and Pen could not set the timeouts values for the serial port.

Failed to get sampling rate Eye and Pen should read the Eyeputer sampling rate (60, 240 or 480 Hz) before launching the acquisition, because the data format is different for each value.

```
Opening port failed: <COM port>
```

Eye and Pen could not open the serial port to communicate with the eye tracker. It is safe to restart your computer.

#### Failed to close <COM port>

Eye and Pen couldn't close the serial port communication channel. If you need to relaunch an acquisition, restart the computer beforehand.

#### No data on <COM port>

Eye and Pen does not receive data from the eye tracker via the serial port. Check the serial connection and the eye tracker configuration on its host system.

# <u>Edition</u>

Only numbers allowed (range separator ".." or ",") You typed a forbidden character in the list of codes.

# XII. WINTAB32-COMPLIANT HARDWARE MANUFACTURERS

Wintab32 is an industrial standard intended to ensure straightforward communication between computers and digitizing tools, such as tablets. This list is not exhaustive.

Company	Web site
ACECAD Enterprise Co. Ltd.	http://www.acecad.com.tw
Aiptek Inc.	http://www.aiptek.com.tw
ALTEK Corp	http://www.altek.com
Aristo Graphic Systeme GmbH & Co. KG	http://www.aristo.de
Communications Intelligence Corp.	http://www.cic.com/
Graphtec Corp.	http://www.graphteccorp.com
GTCO Calcomp Corp.	http://www.gtcocalcomp.com
IQ Automation	http://www.iq-automation.de/
Hitachi Digital Graphics	http://www.hitachi-soft.com/icg/products
KYE Systems Corp.	http://www.geniusnetusa.com/
Mutoh America, Inc.	http://www.mutoh.be/
NEC Corp.	http://www.nec.com/
Numonics Corp.,	http://www.numonics.com
Oce Graphics SA.	http://www.oce.com
Pinnacle Technologies	http://www.pinnacle.com.ph/
Seiko Instruments Inc.,	http://www.sii.co.jp/corp/eg/index.html
Sony Corp.	http://www.sony.net/
Topaz Systems Inc.	http://www.topazsystems.com/
Twinhead Corp.	http://www.twinhead.com/
WACOM Corp.	http://www.wacom.com

# XIII. PARALLEL PORT WIRING

# XIII.1. StimTracker.

The following figure shows how to connect wires of a cable to send data from a PC to a StimTracker box.



Figure 181: parallel port (DB25) to StimTracker (RJ45) wiring

Since StimTracker only connects 6 lines, it is only possible to send codes between 0 and 63.

# XIII.2. Standard parallel cable

A standard parallel cable is a straight cable : each pin is wired to the same pin number on the other side of the cable. Then, if from one side of the cable data are sent from pins 2 to 9 (Data register), they'll be received on the same 2 to 9 pins, on the other side.

Thus, to be able to read these data, the receive parallel port has to be set in a bidirectional mode (Data register is used to receive, not to send). This only possible with ECP ports.

If one of the receiving port is not ECP, a cross wired cable has to be used.

# XIII.3. Crosswired cable

The drawback with this wiring scheme is that not all pins can be used to receive data. Basic parallel port is designed mostly to send data. Only 5 pins can be safely used for reading, then limiting the range of code that can be sent (0 to 31).



Figure 182: Crosswired parallel cable (DB25).

# XIV. BIBLIOGRAPHY

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[ An updated list is held on the web site <u>http://www.eyeandpen.net</u>, in Publications section ]

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