

Whisker: in pictures



www.whiskercontrol.com

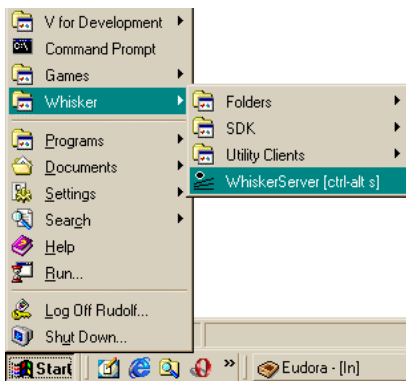
15 Feb 2006

Overview



Whisker_logo_for_manual.tif

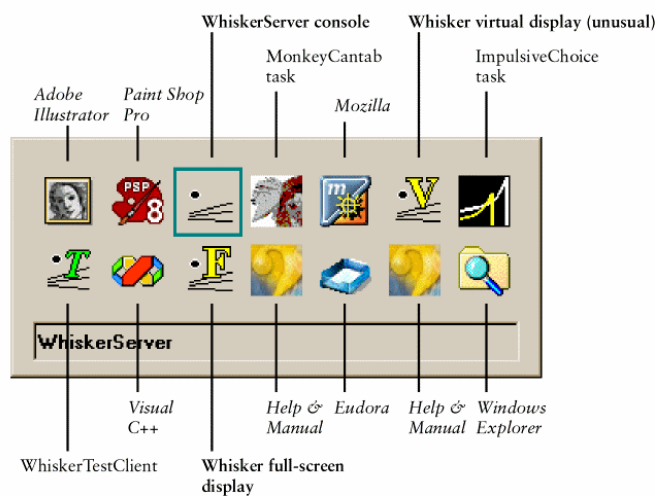
Whisker is installed under Windows.



Start_Menu_With_Whisker.bmp

You run the Whisker server (which talks to the hardware) and Whisker clients (which implement behavioural tasks), together with other programs in Windows.

Example of pressing Alt-Tab to switch windows while running Whisker



AltTab_Key.BMP

Hardware

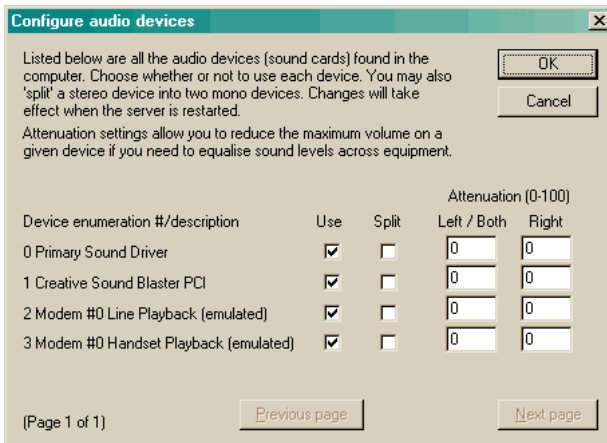
Whisker supports a wide range of hardware, including digital I/O devices from a range of manufacturers...



... touchscreens via the Touch-Base UPDD drivers and any serial port supported by Windows...



... any sound card supported by Windows (also allowing the splitting of a single stereo device into two mono sound devices)...

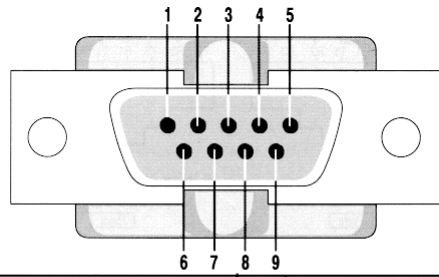


WhiskerServer_ConfigureAudioDevices.bmp

Device#	L/R/stereo	Physical device number	Description	Module	Owner #	Owner name
0	Stereo	0	Primary Sound Driver		0	Test Client
1	Stereo	1	Creative Sound Blaster PCI	ES1370MP.sys	0	Test Client
2	Stereo	2	Modem #0 Line Playback (...)	WaveOut 0	0	Test Client
3	Stereo	3	Modem #0 Handset Playba...	WaveOut 1		

WhiskerServer_AudioDeviceSummaryView.bmp

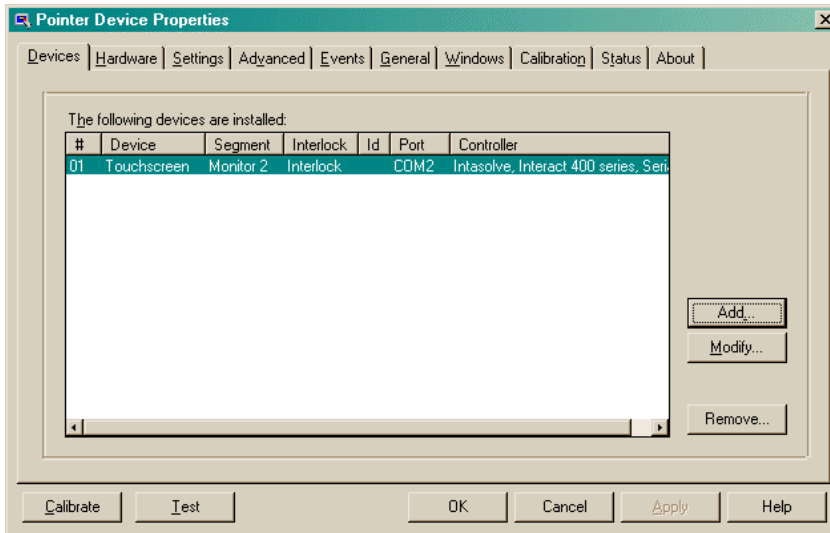
... any video card supported by Windows, including multimonitor cards...
 ... and serial ports used as digital I/O devices.



Pin	Signal	Pin	Signal
1	Data Carrier Detect	6	Data Set Ready
2	Received Data	7	Request to Send
3	Transmitted Data	8	Clear to Send
4	Data Terminal Ready	9	Ring Indicator
5	Signal Ground		

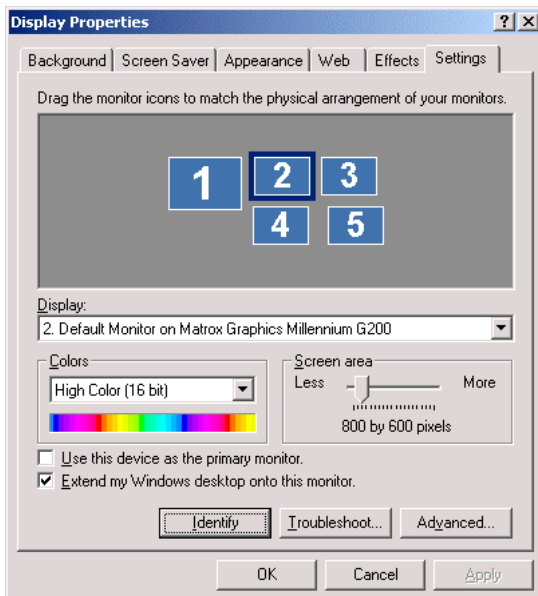
Serial_9Pinlabels.BMP

Whisker uses the Touch-Base UPDD driver to communicate with touchscreens from any manufacturer supported by UPDD.

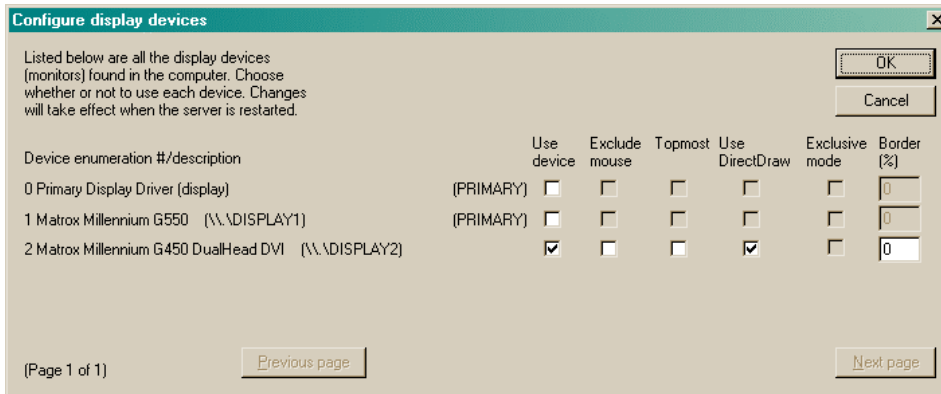


UPDD_y3_Devices.bmp

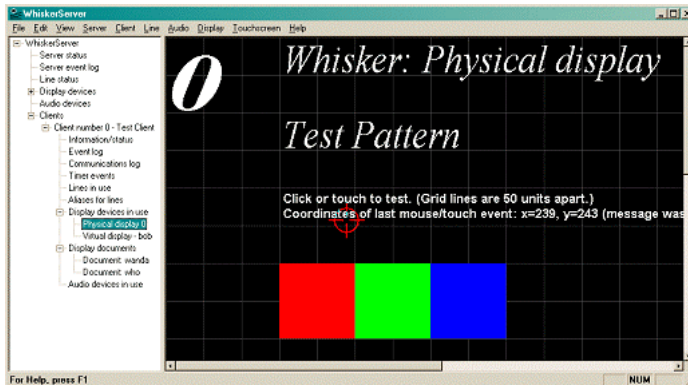
Whisker uses the Windows multimonitor facility to drive multiple monitors (with touchscreen attached, if desired).



Windows_ConfigureMultimonitor.bmp



WhiskerServer_ConfigureDisplays.bmp



WhiskerServer_ConsoleViewOfLargeDisplay.bmp

Whisker allows you to manipulate the on/off state of digital input/output lines directly to test your equipment, and to watch the state of all lines (or all lines being used by a particular task) as tasks are running.

Line number	I/O	State	Pegged	Owner#	Owner name	First alias	ON event	OFF event
0	Input							
1	Input							
2	Input							
3	Input							
4	Input							
5	Input			1	Test Client	Lever	LeverPressed	
6	Input							
7	Input							
8	Input							
9	Input							

WhiskerServer_LineStatusView_SelectingALine.bmp

Whisker monitors its own performance, taking care to aim for 1 kHz hardware polling (1 ms temporal resolution) while never consuming more than 50% of CPU time.

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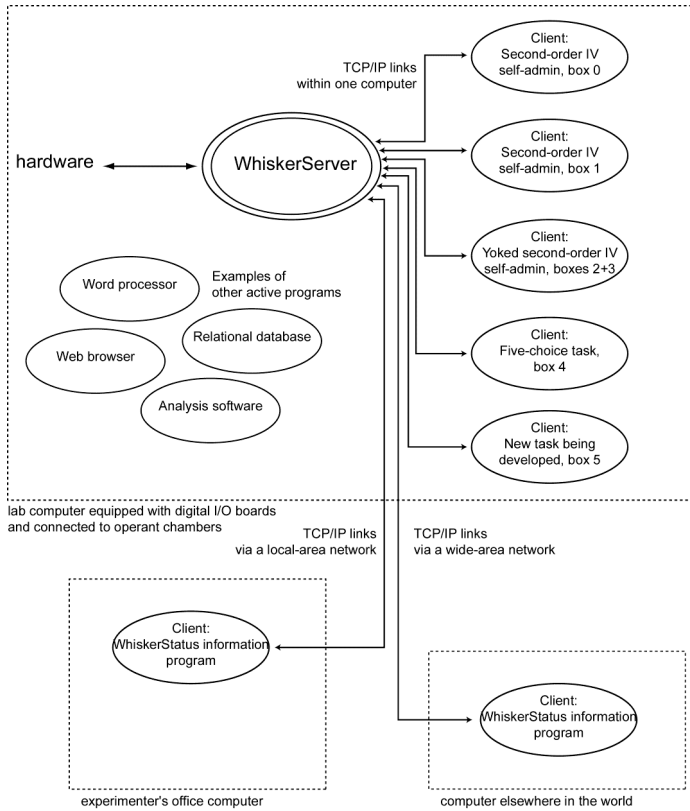
Worst inter-poll interval so far (ms): 2
This display is scheduled to be updated every 1000 ms
Worst inter-poll interval since last update (ms): 2
Since last update, have had 1004 polls and 3 yields
Of those polls, 100.0% were <=10ms, 0.0% were 11-20 ms, 0.0% were >20ms
Longest poll since last update took 96 microseconds
On the high-performance CPU timer, last poll took 186 ticks and last interpoll took 3397 ticks
High-performance CPU timer is running at 3579545 Hz
Server process priority: Real-time

```

WhiskerServer_Performance.bmp

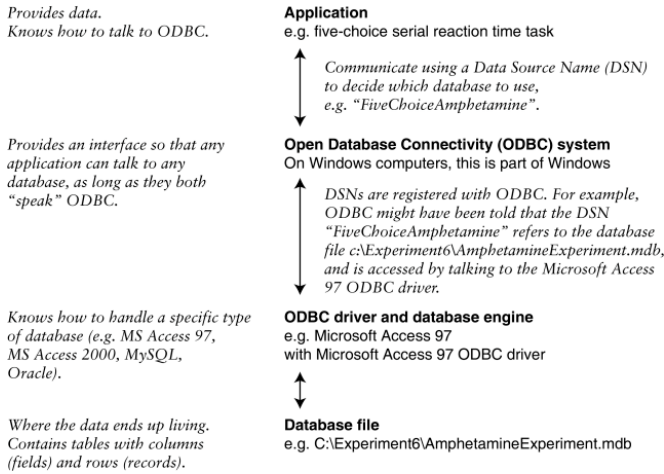
Clients

Whisker uses a client-server architecture.



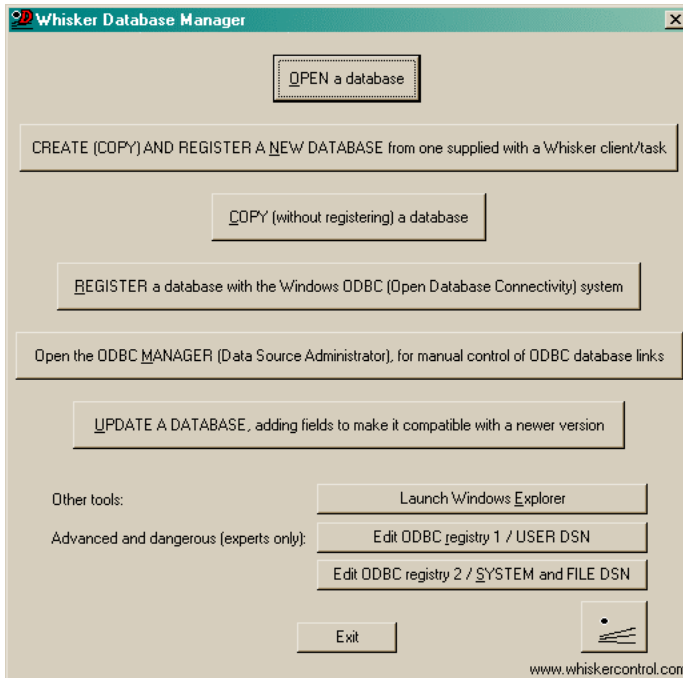
Whisker_software_schematic.bmp

Whisker tasks typically write their data direct to an ODBC-compatible database.



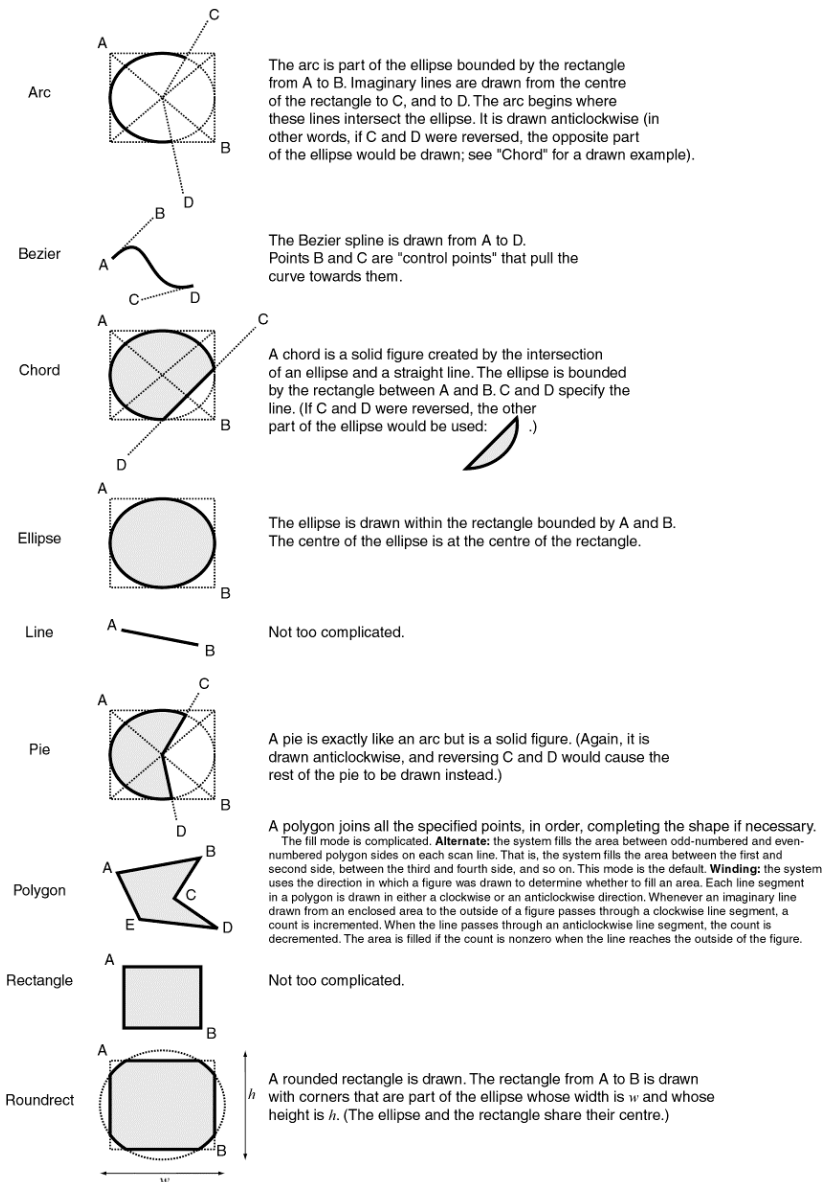
Principles_of_ODBC.BMP

The Whisker Database Manager simplifies the use of ODBC-compatible databases (such as Microsoft Access).



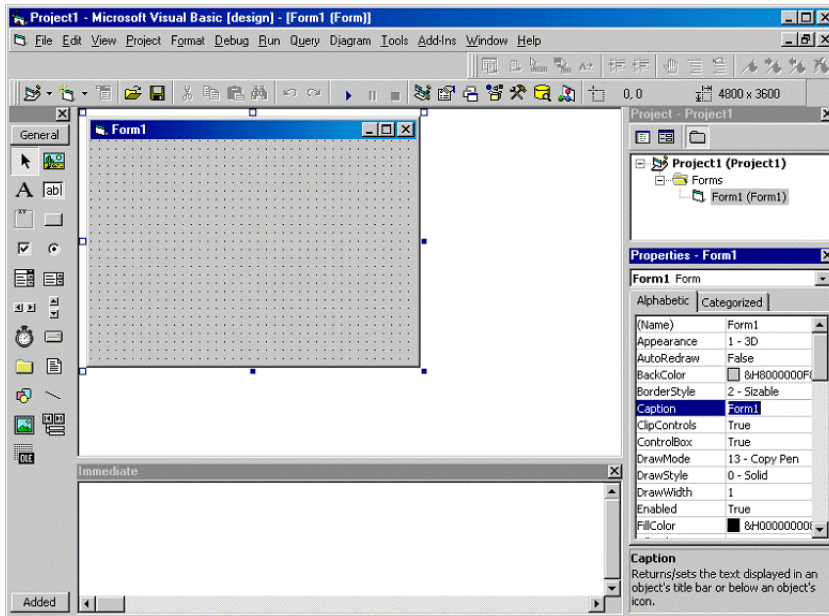
DatabaseManager_Main.bmp

Stimuli can be drawn using any of the Windows drawing primitives, through a simple interface.

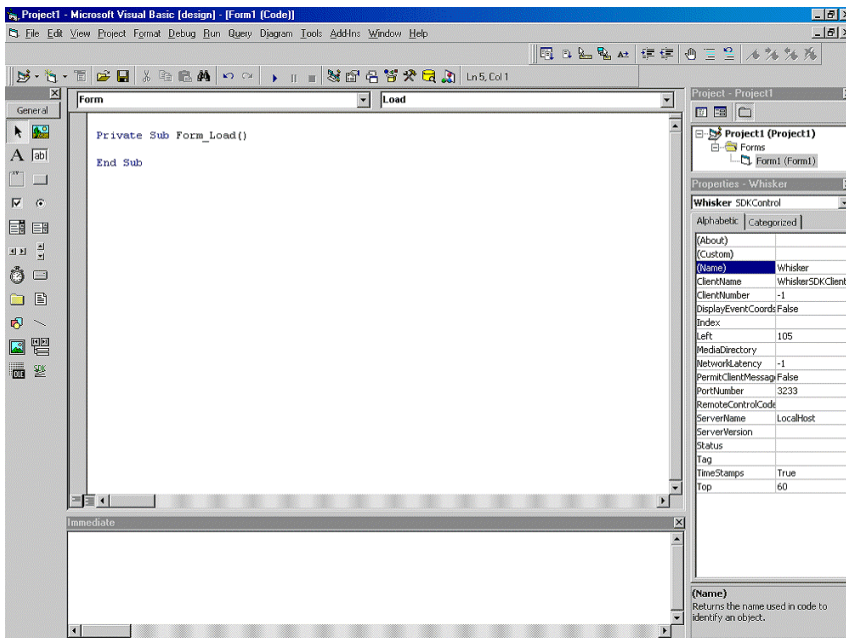


Windows_GDI_drawing.BMP

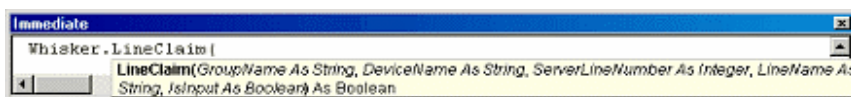
The Whisker Visual Basic Software Development Kit makes the process of developing Whisker tasks easy.



Tutorial1_NewProject.bmp



Tutorial1_FormLoad.bmp



Tutorial2_Licker_UI_2.bmp



LineClaim_SDKMethod.bmp

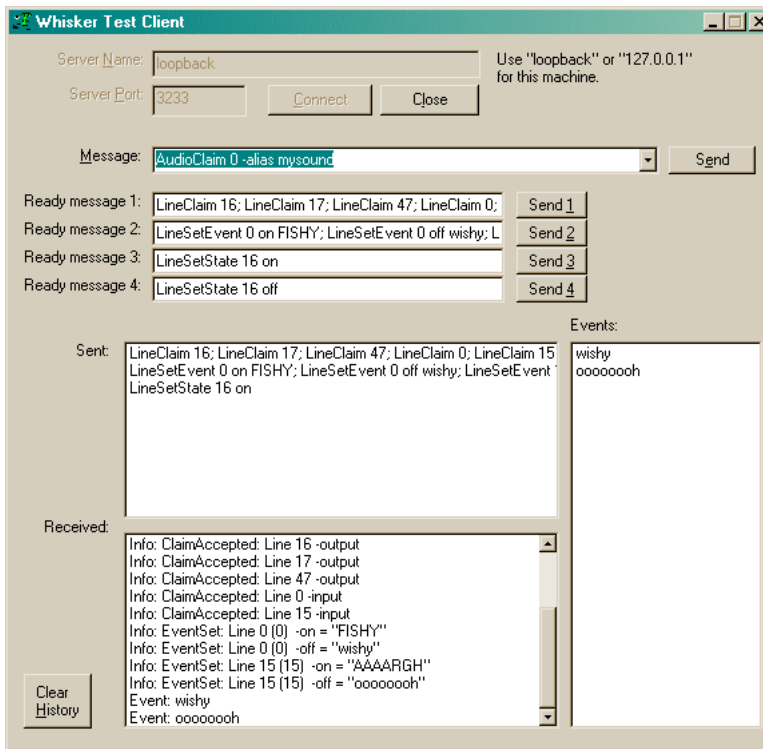


LineReadState_SDKMethod.bmp



LineSetState_SDKMethod.bmp

Whisker uses a high-speed text-based network communication system. A test client allows you to explore what happens behind the scenes.



WhiskerTestClient.bmp

Clients can assign names to individual input/output (I/O) lines.

Line number	Alias
48	HOUSELIGHT
49	LEFTLIGHT
50	RIGHTLIGHT
50	STIMULUS
51	TRAYLIGHT
52	PUMP
52	REINFORCER
53	DIPPER
54	LEFTLEVERCONTROL
54	INACTIVELEVERCONTROL
55	RIGHTLEVERCONTROL
55	ACTIVELEVERCONTROL
72	NOSEPOKE
73	LEFTLEVER
73	INACTIVELEVER
74	RIGHTLEVER
74	ACTIVELEVER
75	LOCOBEAM_FRONT
76	LOCOBEAM_MIDDLE
77	LOCOBEAM_REAR

WhiskerServer_ClientAliasesForLines.bmp

Communication between the client and the server can be monitored for debugging a new client.

Time	Source	Message
18:17:26	Server	Event: Locomotor_Middle
18:17:26	Server	Event: Locomotor_Front
18:17:26	Server	Event: Locomotor_Rear
18:17:27	Server	Event: Locomotor_Front
18:17:32	Server	Event: Active_Lever
18:17:32	Client	ReportStatus Box 5 (m11) - active 482, inactive 58, stim 46, reinf 4 - Task started.
18:17:32	Server	Event: Active_Lever
18:17:32	Client	ReportStatus Box 5 (m11) - active 483, inactive 58, stim 46, reinf 4 - Task started.
18:17:32	Server	Event: Active_Lever
18:17:32	Client	SetState STIMULUS on
18:17:32	Client	SetState HOUSELIGHT off
18:17:32	Client	RequestTimerEvent 1000 0 _sys51
18:17:32	Server	TimerCreated: duration 1000, reloadcount 0
18:17:32	Client	RequestTimerEvent 1000 0 Unit_Schedule_Finished
18:17:32	Server	TimerCreated: duration 1000, reloadcount 0
18:17:32	Client	ReportStatus Box 5 (m11) - active 484, inactive 58, stim 47, reinf 4 - Task started.
18:17:32	Server	Event: Unit_Schedule_Finished
18:17:33	Server	Event: _sys51
18:17:34	Server	Event: Locomotor_Middle
18:17:34	Server	Event: Locomotor_Rear

WhiskerServer_ClientCommsLog.bmp

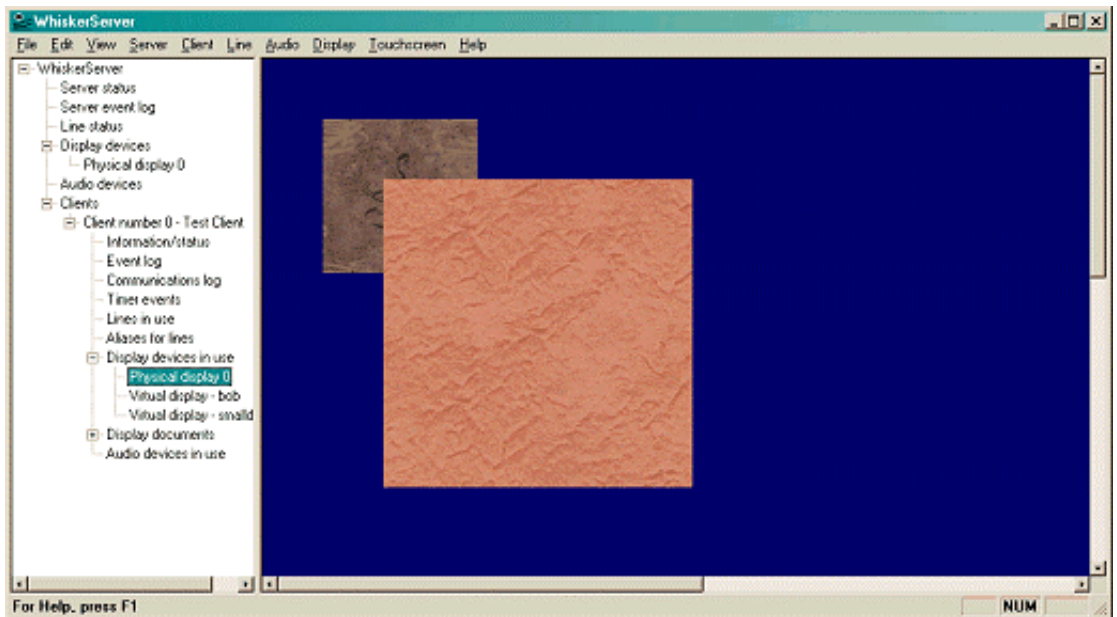
For visual displays, clients can manage several documents, each showing different content, and choose which

Document#	Document name	Number of objects
5	CS_plus	1
6	CS_minus	1
7	CS_both	2

WhiskerServer_ClientDocumentSummary.bmp

document to show to the subject.

The server can be used to monitor what any subject is seeing.



WhiskerServer_ClientIndividualDisplay.bmp

The server allows many clients (tasks) to run simultaneously, and allows you to keep an eye on all of them.

Client #	Name	Status
19	Second-order IVSA [box 0]	Box 0 (m15) - active 377, inactive 5
21	Second-order IVSA [box 2]	Box 2 (m23) - active 141, inactive 1
22	Second-order IVSA [box 3]	Box 3 (m24) - active 109, inactive 2
23	Second-order IVSA [box 5]	Box 5 (m26) - active 108, inactive 2
24	Second-order IVSA [box 4]	Box 4 (m25) - active 98, inactive 9
25	Unnamed 25	

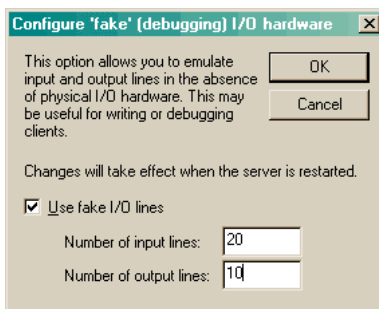
WhiskerServer_ClientSummaryView.bmp

Clients can display things on a screen, respond to touchscreen, mouse, and keyboard events, play sounds, turn devices on and off, and create timers.

Timer event	Duration (ms)	Time to go (ms)	Time to go (min)	# Reloads to go
Session_Finished	7200000	7179611	119	0
Locomotor_Bin_Finished	1200000	1189104	19	Infinite

WhiskerServer_ClientTimerEvents.bmp

Whisker provides advanced debugging features, including the facility of 'fake' devices (digital I/O, audio devices, etc.), allowing you to write tasks and test them on computers that do not have digital I/O installed.



WhiskerServer_ConfigureFakeLines.bmp

Existing tasks

Tasks written for Whisker to date include some of the most popular in their class worldwide, including MonkeyCantab...

Set parameters for MonkeyCantab

Subject details: Load config | Subject ID: test | Session number: 121 | Save config | Comment: testing | OK | Cancel

Data recording: Set data file | test-10Jan2006-2341-MonkeyCantab-summary.txt | ODBC data source name (see Control Panel). Blank to choose later: MonkeyCantab_dat | Pick

Current module (task) list for this subject: Configure general parameters | Configure visual objects

Module order: Add module | Remove module | Copy module | Move up | Move down | Touch Training (v2) | Delayed Matching/Non-matching To Sample | Configure module

MonkeyCantab_Parameters.bmp

MonkeyCantab: General parameters

Links between tasks: Duration (s) 20 | Play sound | Use houselight | Start with link | OK | Cancel

Visual appearance and touchscreen control: Adjust position of touchscreen stimuli to avoid a central feeder | Background colour (each value can range from 0-255; black is 0, 0, 0): red 0 | green 0 | blue 0 | Respond to mouse input as well as touches

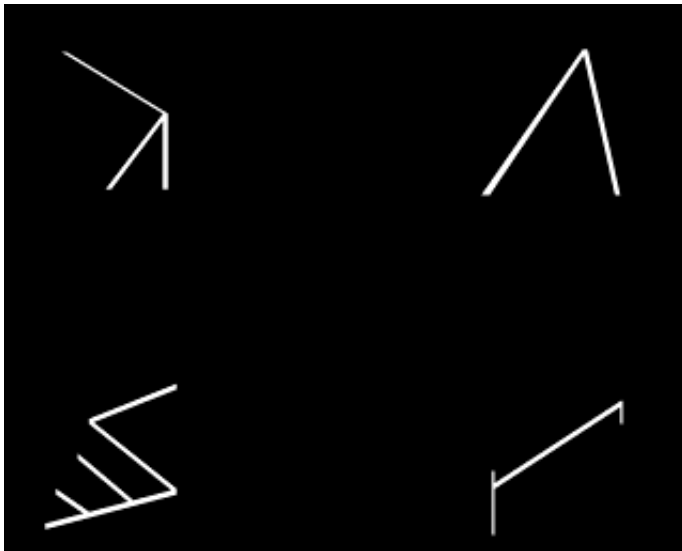
Reward: Give pellet(s) # pellets: 1 | Pulse length (ms): 45 | Time between pellets (s): 0.5 | Turn on pump | Pump reinforcement duration: 5 | Pump contingent upon licking during this time | Each lick delivers liquid for this duration (s): 1 | Play sound | Extra reward device | Duration (s): 5

Punishment: Darkness | Darkness time (s): 10 | Turn on pump 2 (with pumping/licking parameters as for reward) - e.g. mildly aversive saline pump | Play sound | Extra punishment device | Duration (s): 10

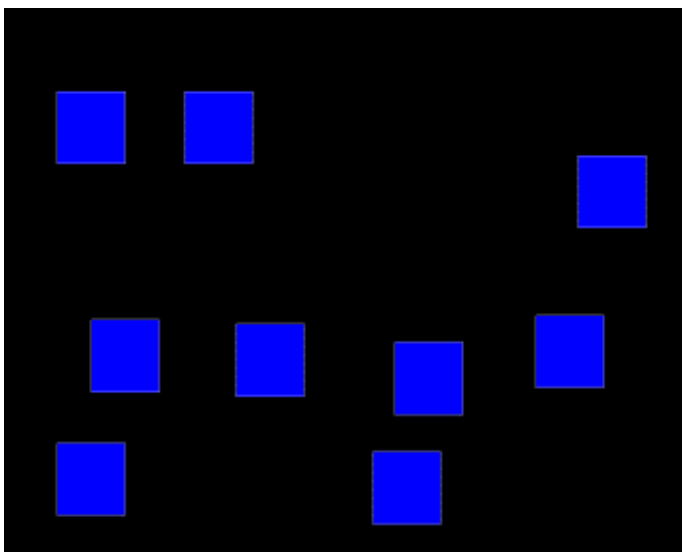
Default media directory (for sounds and bitmaps): | Set

Link	Use WAV	Filename	Set	Frequency (Hz)	Sound type	Duration (s)	Level (0-100)
Reward	<input checked="" type="checkbox"/>	C:\WINNT\MEDIA\U	Set	1500	Tone	1	100
Punishment	<input checked="" type="checkbox"/>	C:\WINNT\MEDIA\	Set	1000	Square	2	100
Marker 1	<input type="checkbox"/>	C:\WINNT\MEDIA\R	Set	500	Tone	1	100
Marker 2	<input type="checkbox"/>	C:\WINNT\MEDIA\R	Set	500	Tone	1	100
Marker 3	<input type="checkbox"/>	C:\WINNT\MEDIA\R	Set	500	Tone	1	100

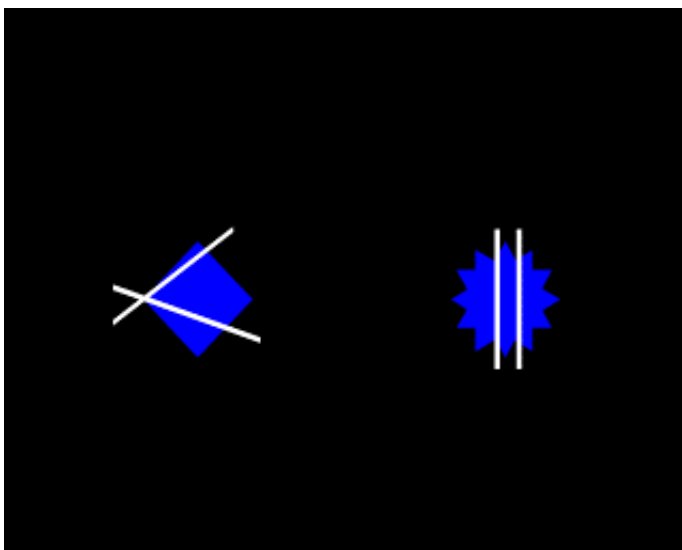
MonkeyCantab_GeneralParams.bmp



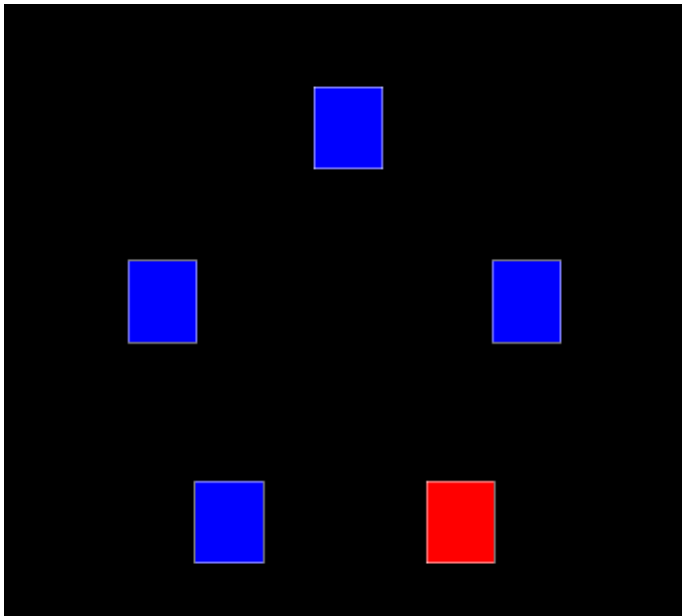
MonkeyCantab_DMTS_Screenshot2.bmp



MonkeyCantab_SWMrunning.bmp



MonkeyCantab_VDS_Screenshot.bmp



MonkeyCantab_5C_5wayscreenshot.bmp

... second-order
schedules of
reinforcement...

Set IVSA Task Parameters

FRx : (FRy:S)
 overall | unit

Subject details
 Rat ID: xxx
 Session number: 9
 Preferred box: 0

Data recording
 Set summary output file: xxx-05Jul2004-1755-SecondOrder-summary.txt
 Set per-response output file: xxx-05Jul2004-1755-SecondOrder-response.txt
 ODBC data source name (see Control Panel). Blank to choose later:

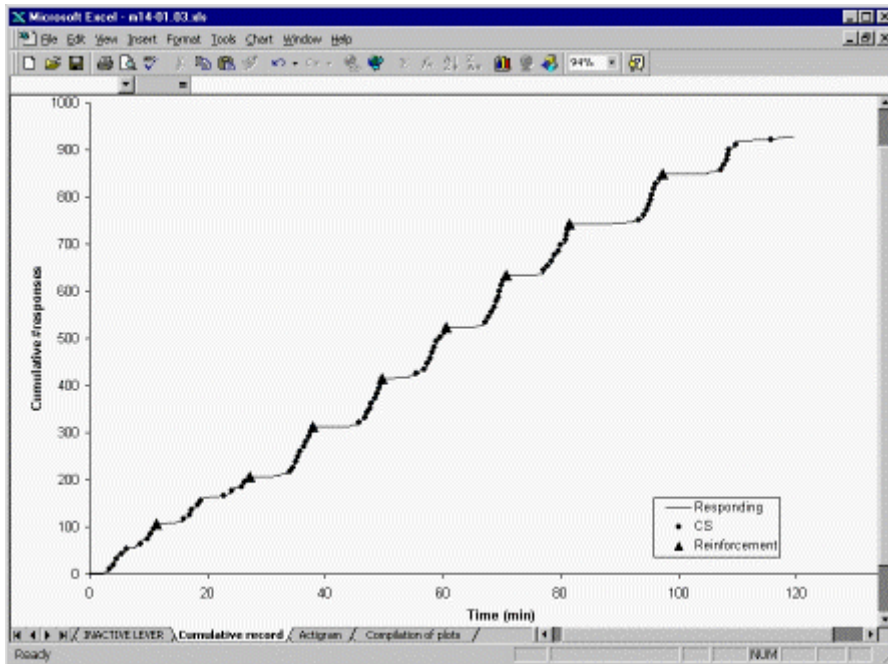
Manipulanda, Global Settings
 Active lever: Left Right Nosepoke
 Retract levers on 'inactive' press
 CS in dipper alcove (rather than over lever)

Reinforcer
 Pump Pump duration (s): 7 (0 = no reinf) Max #reinforcers (0 for no limit): 50
 Dipper #Dips per reinf.: 1
 Dipper DOWN at rest Dip time (s): 2 Inter-dip time (s): 2

Schedules
 Overall schedule type: FR FI VR Reinforce the very first unit schedule completed
 Overall parameter: 10 10 Lever retraction/stimulus time (s): 20
 Unit schedule type: FR FI VR Give stimulus for very first response of the session
 Unit parameter: 10 10 Stimulus duration (s): 2 (0 = no stimuli)

Extra rate limits (applicable when reinforcers are permitted very frequently)
 Minutes to calculate rate over: 0 Maximum reinforcements in that time: 0
 Timeout when maximum rate reached: 0

SecondOrder_Params.bmp



SecondOrder_NiceExample.bmp

... the Seeking-Taking Task...

Set parameters for the Seeking-Taking Task

Subject details: Load config, Rat ID: xxx, Session number: 1, Save config, Comment: <generated automatically>

Quick schedule config: FR1-pump, Seek-Take, Take-Take, Seek-Seek, OK, Cancel

Data recording: Set summary, Set response, ODBC data source name (see Control Panel). Blank to choose later: Pick

DEVICES

Lever assignment: Seeking LEFT, taking right Seeking RIGHT, taking left

Reinforcer-associated CS: Light over taking lever Centre light Light over seeking lever (abnormal) Tone Houelight (NB also used by main task)

Priming/noncontingent stimulus: Light over taking lever Centre light Light over seeking lever (abnormal) Tone Houelight (NB also used by main task)

Reinforcer: Pump - Infusion duration (s): 7.28 Dipper - # dips: 1 Dip time (s): 5 Inter-dip time (s): 1 Down at rest Pellets - # pellets: 1 Pulse length (ms): 45 Time between pellets (s): 0.5

SCHEDULE

PRIMING event Prime all cycles Prime randomized in pairs Prime alternate cycles First cycle IS primed

Completely NONCONTINGENT stimulus, comprising: Priming CS Taking lever Reinforcement (as above) Stimulus duration (s) (N.B. reinf. duration as above): 7 Time from START of stim. to START of next phase (s): 10

Response on taking lever required. Present CS with lever Reinforce press Present CS after response, for 0 s. Wait 10 s after response before starting next phase.

SEEKING lever FR VR FI RI Ext-Timeout FR1-Timeout Parameter: 30 s 0 PIT PIT

TAKING lever FR VR FI RI Ext-Timeout FR1-Timeout Parameter: 1 0

REINFORCER, accompanied by CS (see above), and with the houelight off.

TIME OUT ... of 6 minutes before the cycle restarts This task is over-complex. :-)

Session time limit (min) (0 for no limit): 180 Maximum # reinforcers (0 for no limit): 20

Locomotor recording bin size (min): 10 Give desynchronized noncontingent CSs Settings for desync. CS presentation

SeekTake_Params.bmp

... simple
schedules of
reinforcement...

Set parameters for SimpleSchedules

Subject details: Load config, Save config, Rat ID: xxx, Session number: 1, Comment: (add your comment here), OK, Cancel

Data recording: Set file, ODBC data source name (see Control Panel). Blank to choose later: [] Pick

Context preexposure time (min): 0
Session time limit (min): 60 Total max. reinf. (0 unlimited): 0 Use houselight

LEFT lever: Use it Schedule: CRF - Continuous reinforcement (FR-1)
Parameter(s): [0] [0] [0] Max. # reinf.: 100
 Pellets Qty: 1 Pump Duration (s): 7.28 Dipper Num. dips: 1
 Timeout following reinforcement Timeout duration (s): 0

RIGHT lever: Use it Schedule: FR - Fixed ratio
Parameter(s): 5 [0] [0] Max. # reinf.: 100
 Pellets Qty: 1 Pump Duration (s): 7.28 Dipper Num. dips: 1
 Timeout following reinforcement Timeout duration (s): 0

Timeouts on one schedule apply to both schedules, if two are running
 Progressive ratio schedules terminate based on time since last response (rather than last reward)
 Use changeover delay (for concurrent schedules) Changeover delay (s): 0

Dip time (ms): 5000 Inter-dip time (ms): 1000 Dipper down at rest
Pellet pulse (ms): 45 Time between pellets (ms): 500 Lever debounce time (ms): 10
 Turn on traylight until first nosepoke after reinforcement

SimpleSchedules_Parameters.bmp

... delayed
reinforcement
choice tasks...

Set parameters for ImpulsiveChoice

Subject details: Load config, Save config, Rat ID: xxx, Session number: 1, Comment: (add your comment here), OK, Cancel

Data recording: Set file, ODBC data source name (see Control Panel). Blank to choose later: [] Pick

The lever with VARYING parameters (lever B) is: Left Right

Fixed lever (lever A):
Delay to reinforcement (s): 0 Probability of reinforcement: 1
 Pellets Qty: 1 Pump Duration (s): 7.28 Dipper Num. dips: 1

Variable lever (lever B):
Delays used, in sequence (s): 0,10,20,40,60 Set delays/probs
Probabilities used, in sequence (s): 1,1,1,1
Note: this determines the number of trial blocks, which is: 5
 Pellets Qty: 4 Pump Duration (s): 14.56 Dipper Num. dips: 4

Task structure:
Num. FORCED-choice trials/block: 2 Num. FREE-choice trials/block: 10 Shuffle
 Stimulus light over lever bridges delay Houselight bridges delay (NOT advised)
(= on during delay, collection, feeding)
Initiation limited hold (s): 10 Choice limited hold (s): 10 Collection lim. hold (s): 10
Reinf. collection time (s): 6 Trials begin every: (s) 100 Session time (min): 100.0

Dip time (ms): 5000 Inter-dip time (ms): 1000 Dipper down at rest
Pellet pulse (ms): 45 Time between pellets (ms): 500 Pump safety time limit (s): 10

Quick config with common defaults:
Delay task No-delay test Delays reversed Nosepoke training
Probabilistic task Certain test Probabilities reversed

ImpulsiveChoice_Params.bmp

... the Five-Choice
Serial Reaction
Time Task...

Set parameters for FiveChoice

Subject details

Load config Save config

Rat ID: xxx Session number: 1

Comment: (add your comment here)

Preferred box: 0

OK Cancel

Data recording

Set data file

ODBC data source name (see Control Panel). Blank to choose later: Pick

Target number of trials (correct+incorrect+omission): 100 Session time limit (min): 30

Max number of trials of "all" types (inc. premature) (0 for no limit): 200

Forced-choice task: only offer one hole. Hole number (0-4): 0

Pseudorandom location selection. Draw without replacement from list of length 5 x 1 = 5

Trial details

Rat first required to panel-push (at the back panel). Trial begins with an INITIAL PAUSE. Length (ms): 500,1000,1500,2000 Use traylight

Stimulus is presented, and eventually goes off. Stimulus duration (ms): 500

Rat must respond within LIMITED HOLD (measured from stimulus onset) to gain reward. Limited hold (ms): 5000

Optional noise. Onset measured from stimulus onset (but may be negative and PRECEDE stimulus onset). Noise duration (ms, 0=none): 0

Onsets (ms): Set possible noise onset times

Failure leads to timeouts. Timeout duration (ms): 5000

Front panel responding during timeouts prolongs (restarts) the timeout

Front panel responding while waiting to start trial is punished

Punish perseverative nosepokes following a correct response

Reward size (#pellets): 1 Pellet pulse duration (ms): 40 Interpellet gap (ms): 150

Input debounce time (ms) (responses repeated within this time are ignored): 10

Ignore all line OFF events

FiveChoice_Parameters.bmp

... and many
more.