# User's Guide and Reference
# DirectRT v2020

# DirectRT v2020 Users's Guide

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### Overview

Welcome to the PDF documentation for DirectRT v2020. You can search this documentation using Adobe Acrobat's search tool or by using the table of contents or index at the end of the document. We have designed this document for easy printing from Acrobat should you prefer a hard copy manual. Note that all of the information contained in this document can also be accessed via the interactive help system located in DirectRT's help menu, or by clicking on "DirectRT Help" in the C:\DirectRT\Help folder after installation.

If you are new to DirectRT, we suggest you start by running some of the samples 56 to see what DirectRT can do. You can do this by going through the on-line tutorial or you can access the samples directly in the *Samples* folder in the DirectRT program folder just as if they were real experiments.

If you have a question that these help files do not answer, please visit our support site at support.empirisoft.com or visit www.empirisoft.com/company.aspx to contact us directly.

# 2 DirectRT

## 2.1 DirectRT Features

The following outlines most of the features and functions that DirectRT provides. Where useful, links are provided to related "how to..." documentation.

### Response Times

- Timing resolution of 1 millisecond.
- Response timing is synchronized with the screen display so timing always begins when the screen first begins to draw (eliminates 10-17 milliseconds of random error).
- Works with Windows to reduce the impact of system events while timing is taking place.
- Uses Microsoft's DirectX to gain the fastest access possible to input events from the keyboard, mouse, joystick and soundcard.
- Optionally define minimum and maximum response times 45 and deliver custom message screens for each when violated.
- Collect multiple response times 79 on a single trial.
- Collect key release response times 77 in addition to key press times.
- Define valid keys 31 for any response.
- Define correct key 31 for any response. Optionally require a correct response 75.

### Input Options

- Keyboard, mouse, and joystick input 31 for discrete responses.
- Short open ended (fill-in-the-blank) responses 69.
- Voice responses via microphone 85 connected to your soundcard.
- Option of saving voice responses as wav files 85 on your hard drive.
- Continuous joystick motion 73.
- TTL signals 88 can be read from a defined port to gather data from external equipment.

### Stimulus Presentation

- Create simple or complex visual displays with single or multiple images and text.
- Create as many different displays as you need for any given trial.
- Play sound 83, video or animation 19 files with tremendous precision.
- Can handle multiple simultaneous and/or sequential sound files, with control over left/right panning and frequency (Hz) 84. Easily synchronized with visual stimuli.
- Send precisely synchronized TTL signals 88 to communicate with external equipment (e.g., another computer controlling physiological equipment).
- Present subject's own responses 70 to open-ended questions as stimuli in the same

session.

- Easily create full screens of instructions 22 with formatted text.
- Create multiple style settings 18 with choices of fonts and display colors.
- Present full colour graphics 20 that can be as large as full screen and in any resolution from 640x480 to 1600x1200 and beyond 18.
- Present multiple images and/or text in succession or simultaneously 63.
- Superimpose custom graphics 69 you make (e.g., special rating scales) over any other image or text. Great for pretesting and rating visual stimuli.
- Capture screens from Microsoft PowerPoint 27 and other presentation software and present them as stimulus or instruction screens in your experiment.
- Precisely locate images and text 28 with flexible and easy to use alignment options.
- Display of stimulus screens is synchronized with the monitor's refresh rate 6 resulting in highly controlled presentation rates.
- Enter stimulus presentation times 30 in milliseconds. DirectRT will determine the screen refresh rate and will present the stimulus for the number of screen refreshes that will comes closest to your specified interval. All actual display times are written to a log file 53 for each session.

### Randomization & Trial Structure

- Randomize trials within a single block 17.
- Randomize the order that blocks of trials are presented 17.
- Extremely flexible trial design which can change from one trial to the next.
- Define stimuli directly in the input file or refer to stimulus lists 22.
- Access stimuli from lists sequentially 23, randomly 23, or randomly without replacement 23.
- Create scale responses and multiple choice 69 questions in any format.
- Skip pattern capability 35 when a particular key is pressed on any trial.
- Jump capability 37 -Depending on which key is pressed you can have DirectRT jump to different events (e.g., such as a feedback sequence) and then resume where it left off.
- Option of self-paced or time-limited 30 responses.
- Repeat trials 81 for which stimuli were randomly selected at run-time.

### Data

- Writes data 54 to an easy-to-analyze ASCII file.
- Add optional variables 15 to the data file that identify within subject trial conditions-makes for much easier analysis.
- Includes a utility to easily merge data 9 files collected on different computers.
- Produces two data files 54 per run-one that is simplified and easy to use 52 for most purposes and a more detailed "log" 53 version that records everything including actual stimulus presentation times so you can ensure that your system is capable of achieving

the timing you need.

### Other Features

- Easily modify and re-use your input files experiments.
- You don't have to learn a new editor! Do everything from your favourite spreadsheet application (e.g., Excel, Lotus, Quattro). If you know how to use one of these, then you already know how to edit DirectRT input files.
- Also works great in combination with MediaLab (versions 2000 and later). Just drop a DirectRT session into any MediaLab questionnaire. MediaLab will ask DirectRT to execute the session and will pass along the current subject and condition IDs. When DirectRT is finished, MediaLab will resume where it left off. This is a great way to assign multiple DirectRT input files as a function of between subject factors.
- Runs easily from a command line prompt so you can call the session and execute it seamlessly from your within own programs. You would never know you left your own program.
- Context sensitive help such that pressing F1 at any time will help you with what you are currently doing.
- Easy-to-use intuitive interface–no programming code necessary.

## 2.2 Setup

### System Requirements

DirectRT will run well on most computers running Windows XP, 7, 8, or 10. DirectRT will not run on Windows NT because NT does not support DirectX beyond version 4 (7 or later is required). It is recommended that systems running DirectRT have at least 64mb of memory, a high quality graphics card with at least 16mb of video memory and a processor speed of at least 500mhz. The log files 53 that DirectRT produces will show you whether or not the computer in question can handle your experimental design.

You can tell which version of DirectX is installed on your machine by typing "dxdiag" from the run command on the Start menu. If DirectX is installed, doing this will tell you which version you are currently running. If you have version 7 or later installed, you can click on the "Display" tab to ensure that there are no problems or warnings given with regard to the compatibility between DirectX and your display adaptor (video card). If there are no warnings, then all should be ok. If you'll be using sound with DirectRT, you can do the same with the "Sound" tab.

Finally, it is also necessary to have a spreadsheet application installed (e.g., Excel) if you plan to edit or view the DirectRT input and output files on that machine--or if you plan to try the DirectRT on-line tutorials. All input and output files are created and saved in .CSV format that are editable using any standard spreadsheet application. See File Format 13 for more details. You do NOT have to have a spreadsheet application installed simply to run the experiments and gather data. Note that users in a few countries may have to set their "Regional Settings" in the Windows Control Panel to that of the United States in order to correctly view and edit .csv files in Excel.

### Backward Compatibility

If you are accustomed to using a previous version of DirectRT (v2000-v2020), you should be able to continue using v2020 without having to learn anything new. DirectRT v2020 is backward compatible so that DirectRT experiments from all previous versions should run the same as they always have without requiring modification. Of course, be sure to confirm compatibility for yourself with any old experiments prior to scheduling participants. As we continue to update v2020 with new fixes and features, we will post the changes on our support site at:

http://www.empirisoft.com/support/forum.php

### Installation

To install DirectRT, double-click on the downloaded file "drt2020.x.x" (where x.x indicates the current release). The installation program will guide you through the set-up procedure. After the setup is complete, follow the security instructions below to gain authorization for each workstation to run DirectRT. Note that we periodically release updated packages, so feel free to check for and download newer releases at any time from our download webpage.

### Security

To help control unauthorized distribution and use of DirectRT, it has been secured with ATX™ software protection. DirectRT will not run on any machine until this security has been disabled. To disable the security follow these steps:

- Install and run DirectRT.
- You will receive a message that the current workstation requires authorization to use the software, and a 14-character code beginning with a D will be displayed.
- Email the code that appears to sales@empirisoft.com. If you are an authorized user, you will receive a translation of this code which will be a registration number unique for the machine on which you have installed DirectRT (generally within one business day). DirectRT should now be fully functional. If you are not yet an authorized user, you may still request a code which will allow you to use and evaluate DirectRT for up to 21 days. Important: ATX™ codes are unique to every machine. Be sure to get authorization for each machine that will be using the software. If you have any difficulty at all with this procedure, please contact us for assistance.

### The Ultimate in Convenience.

If you belong to an organization that has purchased a site license then we can hard code your department's IP patterns into our software so that ANY machine conforming to that pattern (e.g., 123.123.123.*) will start up right away. Ask sales@empirisoft.com for details.

### System Settings

We recommend the following for your general system set-up:

**True colors.** To allow for the full range of colors usable by DirectRT, it is recommended that you use 16, 24, or 32 bit color. Many systems are set by default to 8 bit , which provides for only 256 colors (colors or color ranges may appear as dots, patterns, or solid regions). To set this option, right click anywhere on the desktop and then select Properties. Choose settings, and then select the highest color range possible. 24 and 32 bit color ranges are both capable of displaying close to the full range of colors detectable by the human eye.

**Show file extensions.** File extensions, the three-letters following the period on file names (e.g., .txt, .csv, .bmp), are commonly used and referred to in DirectRT. For this reason, it is advisable that you don’t instruct Windows to hide these from you. To set this as a default in Windows XP, Vista & Windows 7, go to Computer (WINKEY+E.). Press the Alt key to show the toolbar and select Tools > Folder Options. Then click the View tab, uncheck Hide extensions for known file types, and click OK.

## 2.3 Introduction and Key Concepts

### DirectRT or MediaLab?

Many users ask us if they should use MediaLab, DirectRT or both. Whether you use one or both depends on what your needs are. MediaLab's strength is in its flexibility and ease-of-use with respect to traditional self-report questionnaires (many closed and open-ended question formats) and multi-media stimuli (movies, sound, html, word documents, powerpoint shows, etc.). You can use its point-and-click interface to quickly create an attractive questionnaire or experiment. It also creates data files in a horizontal (one row per subject) format that are very easy to work with and ready to analyze in Excel or SPSS.  All of MediaLab's multi-media flexibility requires that it be a traditional Windows program, meaning that the any measures of display and response timing are also subject to the variations of the Windows operating environment. Thus, projects involving tasks like cognitive/perception trials (e.g., priming/lexical decision style tasks) that require measures of stimulus presentation and response times reliable and accurate to the millisecond are not as well-suited to MediaLab.

This is what DirectRT is excellent for.  You get total control over timing because it's a DirectX application and not a "Windows" program. Basically, it was created to do what MediaLab can't do well–high precision cognitive/perception, "blocks of trials" types of tasks. You define your trials in a spreadsheet (e.g., Excel) so you can use your favourite spreadsheet app for editing the input files (a very nice benefit). Due to the nature of DirectRT experiments, the data files are vertical (e.g., one row per trial). This means it takes a bit more skill to collapse and analyze the data. Although some tasks could be easily done with either program, one or the other is usually a clear choice.

Both programs are stand alone, but they do work very well together as complements. A lot of people use both and embed DirectRT sessions within a more general MediaLab experiment. That's the gist of the difference.

### Timing is Everything

DirectRT is all about timing. Windows is generally a very chaotic environment to work in when it comes to controlling the timing of events. This is a primary reason why Microsoft introduced DirectX, a software development platform that provides programmers with direct access to your computer's hardware. Commonly used for the development of high-end 2 and 3D graphics applications and video games, DirectX provides a programming environment ideally suited for the rigorous demands of computerized psychological experimentation. For our purposes, the most important element of DirectX is DirectDraw--a system allowing direct access to your computers display hardware. What this means essentially is that the timing of what you see on the screen and when you see it can be controlled with great precision.

### Screen Refresh Rate

Refresh Rate is one of the most fundamental concepts in high precision computerized experimentation. The screen refresh rate refers to how long it takes your computer to redraw what you see on the monitor. It is often expressed in Hz (e.g., 60Hz, 100Hz) which refers to the number of times your screen is refreshed (or redrawn) in a single second. This can easily be converted to milliseconds by dividing it into 1000, e.g., 60Hz = 1000/60 = 16.67ms per refresh; 100Hz = 1000/100 = 10ms per refresh. Why is this so critical?

Because everything DirectRT displays will be in multiples of the refresh rate and in perfect synch with the refresh rate. For example, if your refresh rate is 10ms, then DirectRT can display stimuli for 10ms, 20ms, 30ms, 40ms, 2000ms, or 2010ms, etc. So if you have a 15ms refresh rate and you want to show a stimulus for 12ms? Forget about it! 0, 15, 30, 45, 60… get the idea? Fortunately you don't have to worry much about this. You can ask DirectRT to display stimuli for any amount of time you like. Based on your refresh rate, DirectRT will display your stimulus for as many screen refreshes as it takes to come closest to your requested display time and will create a log data file for you so that you can compare requested against actual presentation times. See Screen Size[48] for additional detail.

### The Input File

The next great truth - to run a DirectRT session, you need an input file. This file will tell DirectRT what to present as well as where and when to present it and when to take reaction times. So how do you create an input file?

### Use Your Spreadsheet Skills!

A key DirectRT concept is that you create an input file using whatever spreadsheet application you are most comfortable with. If you know how to work with a spreadsheet in Excel or other application then you already know how to edit DirectRT input files. When you're done creating or editing your input file, you simply select *Save As* from the file menu of your spreadsheet application and save your input file in the .CSV format[13] (comma-delimited).

The appeal of the .CSV format is that anybody can edit any DirectRT input file with any spreadsheet editor and then save it in this common format. This way no one has to learn how to use a new editing program for creating their input files. Everyone can use the spreadsheet application they already know best.

### Structure of an Input File

When DirectRT reads your input file, it reads each row of your spreadsheet as a "trial." Because a spreadsheet can have as many rows as you like, you can put as many trials as you like in your input file. Just remember each row is a trial.

For each trial there are a few initial columns in which you specify general information about that trial, such as block[14] and trial[15] IDs, what experimental condition(s) the trial belongs to, how it's supposed to be randomized and so forth. But then comes the really powerful and fun part about DirectRT-Screens!

### Screens

For each trial, your input file tells DirectRT to create a series of 'screens'. A screen refers to what is supposed to be displayed on the monitor at a given time. This might be a stimulus word, some formatted instructions in a text file[22], a precisely located[28] image, a full screen full color image, a sound, a movie, an animation, or any combination of these. Before a trial begins, DirectRT thinks briefly but intensely about the trial, creates the screens as you have specified, holds them all in memory and then flips through them - displaying each for the number of screen refreshes that best approximates the amount of time you've requested.

This sounds like it might be complicated, but it's actually quite easy once you've seen it in action. Creating a new screen for a trial is easy. You simply add 3 new columns to your input file: Stim[19], Loc[28], & Time[30]. In the Stim (short for Stimuli) column, you enter what you want to appear on the screen. In the Loc (short for Location) column, you specify where you want it placed and whether you want it to be added to or replace the previous screen. DirectRT is very flexible in terms of creating screens-either from single or multiple stimulus sources. Finally, in the Time column, you specify how long the screen is to be displayed (in milliseconds) before DirectRT flips to the next screen in your trial. In the Time column you can also indicate that a response time is requested rather than automatically proceeding.

That's it. 3 columns-Stim, Loc, & Time. Remember this and you're set! You just keep adding a new set of three columns labeled with these same headers until your trial has been specified. Some trials might have only 1 or 2 sets, others may have 5, 10 or more. One appeal of this method is that it's very easy to create basic trials in just a few minutes. However, it will become apparent that with a few easy tricks you can also create very elaborate trials with minimum effort.

### Styles

To save time, you can store font, color, alignment and miscellaneous RT information in a Styles (.DRT) file[39]. Combinations of such variables can be created and saved with a single style code[42]. One of the initial columns of the input file is the Style[18] column-this is where you tell DirectRT which of your styles from your Styles (.DRT) file you want to apply to the trial. You can drop a copy of any Styles file into the folder that contains your input file, modify as you like, and DirectRT will automatically use it when running your session. If you don't do this, then DirectRT will simply access the default Styles file located in the main DirectRT program folder--'styles.drt'.

### Running an Input File

By this point your work is done. You simply need to run the input file[13]. There are three ways to do this. The easiest is to run DirectRT.exe--there should be a shortcut icon for it located on your desktop if you chose this option during the installation of DirectRT. From the file menu[49], select "Select and run input file," or hit Ctrl-S. Find and select your input file and then enter a subject and condition ID (these are for your own tracking purposes) and press OK. To stop a session early, press "Esc" and the session will end and the data up that point will be saved.

You can also run your input file from MediaLab[51]. Simply select "DirectRT Session" as a questionnaire item and enter the input file in the File field. MediaLab will pass the current subject and condition IDs to DirectRT, launch the session, and then resume where it left off when the session has completed. It is strongly recommended that you insert at least one MediaLab item (e.g., a basic instruction screen) between any DirectRT sessions you have right next to each other in a MediaLab file just to give each session enough time to start and finish.

Finally, you can run an input file from any program or batch file using a command prompt [51].

### Viewing the Data

Just like input files, DirectRT uses the comma delimited or .CSV format[13] for data or "output" files. This means you can view and edit the data again using your favorite spreadsheet application such as Excel. All data are written to a "Data" folder stored in the same location as the input file. If this is not possible (e.g., the input file is on a CD-ROM), then it will be written to the "Data" folder located in the main program folder. You can select "Open Output File" from the main menu in DirectRT or find and select the file from Windows Explorer (which you can also launch from the main menu).

Note that there are two data files produced for each input file. One is a short version[52] and the other is a longer more detailed log version[53]. The shorter one will usually do for most purposes and is easier to deal with. However, when you want detailed information on each trial including the actual time each stimulus was presented for each trial etc., then the longer version can be found in the "Log" subfolder.

### Samples

A variety of samples[56] have been included to illustrate the various capabilities of DirectRT. These input files are located in the "Samples" folder of the main DirectRT program file folder. Try running each of these samples and then look at the input file to see how it was done.

**Good luck and thanks for trying DirectRT!**

## 2.4 Main Menu Commands

The main menu commands are found at the top of the DirectRT program window. These are the general commands used for executing input files, opening input files for editing, viewing data files, and other general purposes. The descriptions contain links you can click to learn more about the topic.

### Files

#### *Open Input File*

Select and open an input file for editing. DirectRT will open the input file with your system's default application for editing .CSV files (e.g., Excel, Lotus, Quattro). To learn about input files, see Creating Input Files[13].

#### *Open Output File*

Open a data file for viewing. As with input files, DirectRT will open the data file with your system's default application for editing .CSV (e.g., Excel, Lotus, Quattro) files. To learn about DirectRT data files, see Overview of Data Output[54].

#### *New Input File*

Generally, it's recommended to copy a sample folder and modify the files when starting a new experiment. This is an alternative which allows you to create and open an input file for editing based on the "input template.csv" file located in the main DirectRT folder. DirectRT will open the template input file with your system's default application for editing .CSV files (e.g., Excel, Lotus, Quattro). To learn about input files, see Creating Input Files[13].

#### *Launch Explorer*

Launches the Windows Explorer for file exploration and handling.

#### *Select and Run Input File*

If you haven't executed the input file before, this choice allows you to search through the folders on your machine to find the desired input file. Locate the input file and then either double click on it, or select it and click "open." To learn about executing an input file, see Running an Input File[49].

#### *Run Last Input File Again*

This choice will execute the input file most recently run on the machine. The key sequence

"Ctrl-R" will perform the same function. This command is handy when multiple participants are being run back-to-back using the same input file, or when you're developing and testing an input file.

#### *Run a Recent Input File*

DirectRT keeps track of the ten most recently run input files and displays them in the Files menu. Clicking on any one of them will re-run the selected input file (assuming it's where you left it).

#### *Clear Recent File List*

Clears the list of recent files. Clears the list only-doesn't have any impact on the files themselves.

#### *Exit DirectRT*

Ends the program Ends the program (an alternative is to just double-click on the black space).

### Edit

#### *Default Styles*

Edit the default styles file located in the main program folder (styles.drt). To learn about styles, see About Styles and the Style Editor[39].

#### *Recent Style Files*

Choose from a list of recently edited Styles files.

#### *Clear Recent File List*

Clears the list of recent files. Selecting this option only clears the list and doesn't have any impact on the files themselves.

### Tools

#### *Test Refresh Rate*

Determine the refresh rate[6] of your display.

#### *Show System Info*

Display hardware and software configurations of the current system. If you are experiencing display problems with DirectRT, this is a good place to start. Click on the Display tab and check the notes section. Are any problems noted here? See Trouble Shooting[12] for more detail.

#### *Reduce Data Files*

We have created a program that reduces the individual DirectRT data files (and ANY other vertical data files) into a single, one row per subject data file for immediate analysis. The reduction program is extremely powerful, allowing options to block, recode and make new variables. The goal was to save users hours of time in getting many large data files into a single useful file. You can find it and accompanying files in a folder named *Data Restructure (DirectRT)* in the *Utilities* folder.

### *Merge Data Files*

Utility program provided to help you merge data files collected from multiple subjects. This utility simply automates the process of appending multiple text files into a single file. After starting the data merge utility, you can find a quick tutorial for it from its Help menu. For direct access, the file merge utility is located here: …\DirectRT\FileMerge\filemerge.exe

### *Voice Response Setup*

Utility program provided to setup and test your microphone for input with voice activated response times. For direct access, the SoundCheck utility is located here: …\DirectRT\SoundCheck\SoundCheck.exe. It is recommended you run this on each machine if doing VoiceRTs 85.

### *TTL I/O Test*

Utility program provided to test the input/output routines used by DirectRT to communicate with the external world. This utility will let you send TTL signals 88 to any port you like and will let you continuously monitor the value at any port. Since the code is identical to that used by DirectRT it's an easy way to make sure all is well with TTL operations. For direct access, the IOTest utility is located here: …\DirectRT\TTL\IOTest.exe

### *Show Status Bar*

Sets the option to display or hide the status bar that appears at the bottom of the DirectRT window. In rare cases, this status bar may appear during sessions. If you find this happening on your machine, you can prevent it by hiding the status bar with this option.

### *Overwrite Warning*

Sets the option to warn you if the data for a particular subject ID already exist. If unchecked, DirectRT will automatically overwrite old data sharing the same ID.

## Help

### *Help Topics*

Opens this help file at the beginning

### *DirectRT Samples*

Takes you directly to the Samples section 56 of the Help file where the various sample files are described. This is handy for pulling up relevant samples when designing input files.

### *About*

Displays the current version of DirectRT installed on your system.

### *License*

Provides a way to enter a new license code. Useful if you are using a trial code and want to replace it with a purchased code before the trial expires.

***Key Codes***

Takes you directly to the key codes page 93 in the help file.

**Status Bar**

Displays the most recently executed input file along with the subject and condition IDs that were used. Time and date are also displayed.

## 2.5 TroubleShooting

Answers to many common trouble shooting questions can be found at our support site: http://support.empirisoft.com.  If you can not find the answer to your question there, you may register a username and password and post your question directly on the support site. This is often the fastest way to get an answer from us or maybe even one of our other helpful users. If for some reason, you can not get the answer you need via the support site, then contact us directly through email at support@empirisoft.com.

No matter which route you take, there are two basic types of trouble you might experience while trying to use DirectRT. The first is trouble associated with a particular input file and the second is trouble associated with the program in general. Here are some questions we're likely to ask depending on your situation.

### Input File Trouble

If you're having trouble with an input file you're working on, but otherwise DirectRT is running fine (e.g., samples work ok), then:

- Send us a copy of your input file with as few trials as possible to illustrate your question. This will help us see as quickly as possible what's going on. If we can quickly see and replicate the issue here, then we can usually solve the problem very quickly.
- Send us a copy of the Styles file you are using. This is the file with a .drt extension on it usually located in the same folder as your input file. This isn't necessary to send but is often helpful depending on the issue. See Style Files 39 for more detail.

### System or Software Trouble

If it's an apparent bug that you've found, or some unusual behavior, try to tell us the following in your email:

- Does the same thing happen on multiple machines, or just one? Problems that replicate are usually much easier to fix!
- Is it seemingly random or predictable? Do you have to do something specific to make it happen?
- Does the same thing happen with any of the samples that come with DirectRT or is it specific to a single input file that you've created (see above)?
- What version of DirectRT (i.e., ver20xx.x.xxx) are you using? You can find this by clicking "About" on the Help menu. What version of Windows are you using? Have you tried making sure that no other programs are running at the same time that might be causing some kind of interference?

Note that the samples that come with DirectRT should always run fine. If they don't, you may have a system problem. In this case, the first thing to try is usually making sure you have the latest version of DirectX and an up-to-date video driver.

Another thing we can do is look over your system diagnostics and see if there are any obvious problems that could be corrected. If you want to try that, here is how you do it: Type "dxdiag" from the "Run" command on the Windows "Start" menu. You will get a complete diagnostic description of your system. If you then click "Save All Information" and send the resulting file to us, we'll take a look at it and see if we can see anything problematic. You can also check for some obvious problems here yourself--the display tab in particular may indicate you could benefit from a driver update or other action.

Note: When checking your diagnostic file you might check to see if you have one of the following three video systems that are known for their problems with DirectX applications:

Nvidia Riva TNT2, ATI Rage Pro Turbo, Intel 810e Chipset

If so, a video card upgrade-an Nvidia brand card should be a safe choice-may be the fastest solution.

# 3 Input Files

## 3.1 Creating Input Files

Go to a specific topic:

- Block 14
- Trial 15
- Optional Fields 15
- RBG 17
- RWG 17
- Style 18
- Stim 19
- Loc 28
- Time 30
- Skipping 35
- Jumping 37
- File Format 13

It is recommended to first read the DirectRT Introduction and Key Concepts 6 before reading this section. It explains the fundamental concepts associated with Input Files. It is also highly recommended that you check out at least a few of the samples 56 before beginning here. Note that you can go to the samples at any time by clicking on Samples in the left hand window, by clicking the Samples button on the top of the help window, or by clicking Samples on the Help menu of the main program window.

Note that when you click on any sample, a window for that sample will appear. In the window will be a short description of what the input file does as well as the option to view the input file, the actual session is produces (you'll see it in action) and the resulting data file.

This is a handy page to come to when you want to know details about a particular column or general features of an input file.

## 3.2 File Format

### QuickInfo

**All input and output files used in DirectRT are saved in the .CSV format. This standard comma-delimited format allows editing of input and output files using any favorite spreadsheet application.**

** Excel and some other programs may tell you that saving in the .CSV format will cause a loss of formatting and/or other info. This is fine and in no way will harm your input file.

** Users in a few countries may have to set their "Regional Settings" in the Windows

Control Panel to that of the United States in order to correctly view and edit .csv files in Excel.

### CSV File Format

A key DirectRT concept is that you create an input file using whatever spreadsheet application you are most comfortable with. If you know how to work with a spreadsheet in Excel, Quattro, Lotus or other application then you already know how to edit DirectRT input files. When you're done creating or editing your input file, you simply select *Save As* from the file menu of your spreadsheet application and save your input file in the .CSV format (comma-delimited).

### Hints:

When you ask DirectRT to open an Input or Output file it launches the application set by default to open .CSV files on your computer. If there is no default set, you may have to indicate which application you want to use when you first try this. Simply choose whichever spreadsheet program you like to use. If the default program is set but you want to change it then do this:

Go to Windows Explorer and find a file of the .CSV type. Click it once to highlight it and click the right mouse button on the file and select "Open With." Find and select your desired spreadsheet application. DirectRT will now send your files to that application for viewing and editing.

## 3.3 Block

### QuickInfo

**A label to help you keep track of which trials are which. DirectRT for the most part does not use this number but does write the assigned value to the data file for your reference.**

### Value

Any Integer. A "0" specifies the trial data is not to be written. By default, only trials on which data are collected will be written. A negative block ID (e.g., -1) will force DirectRT to write data even if no response is collected (e.g., display-only trials).

### Details

If you are repeating sets of trials within a single input file, you may wish to label each trial with the set to which it belongs. You may use any integer value for any trial. Using the value of "0" will indicate that the data obtained for that trial is not to be written (e.g., in the case of instruction or debriefing screens).

### Hints

You may be including a series of instruction screens or "rest" trials in your session. If you do not want these trials to clutter up your data files then assign them a Block value of 0. Data will not be recorded for any trial with a block value of 0.

## 3.4 Trial

### QuickInfo

**A label to help you keep of which trials are which. As with block labels 14, DirectRT largely doesn't care what values you use. The values are primarily for your references and will be written as labels to the data file with each trial. DirectRT does use the trial labels though when performing skip 35 and jump 37 behaviors.**

### Value

Any Integer.

### Details

DirectRT presents trials as they appear sequentially in the input file. Consequently, trial labels do not have an impact on the order in which trials are presented. Trial numbers become important only when you have skip 35 or jump 37 patterns in your input file.

## 3.5 Optional Fields

### QuickInfo

**Provides an easy way to write unique trial information to each record in the data file based on within-subject trial factors. Can make data analysis easier by identifying important trial characteristics a priori (as opposed to figuring it all out afterwards). DirectRT does not use these columns in any way except to write as labels to your data file.**

### Details

As the name implies, optional fields are, optional; you do not need to have any optional fields in your input file. Immediately following the Block and Trial columns you can insert any number of columns with header values starting with a !

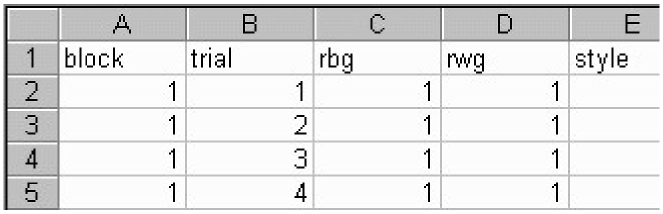
Values from these columns will be copied with the other trial info to the data file.

### Example

Imagine you have a simple 2x2 design. On each trial you present either a positive or negative image (prime) followed by either a positive or negative word (target).

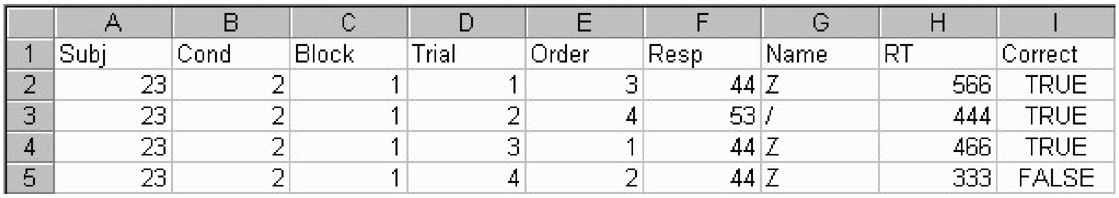
### Without Optional Fields (default)

The first few columns of your input would normally look like this:



| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | block | trial | rbg | rwg | style |
| 2 | 1 | 1 | 1 | 1 | |
| 3 | 1 | 2 | 1 | 1 | |
| 4 | 1 | 3 | 1 | 1 | |
| 5 | 1 | 4 | 1 | 1 | |

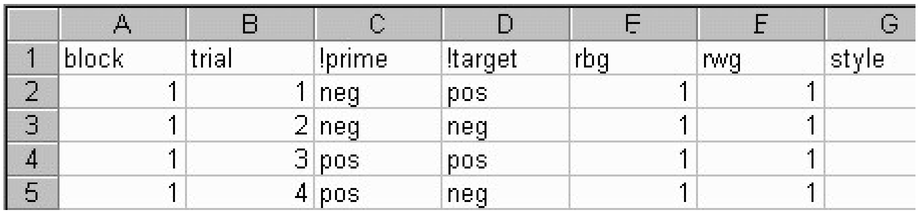
This would produce a data file that looked like this:



| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Subj | Cond | Block | Trial | Order | Resp | Name | RT | Correct |
| 2 | 23 | 2 | 1 | 1 | 3 | 44 | Z | 566 | TRUE |
| 3 | 23 | 2 | 1 | 2 | 4 | 53 | / | 444 | TRUE |
| 4 | 23 | 2 | 1 | 3 | 1 | 44 | Z | 466 | TRUE |
| 5 | 23 | 2 | 1 | 4 | 2 | 44 | Z | 333 | FALSE |

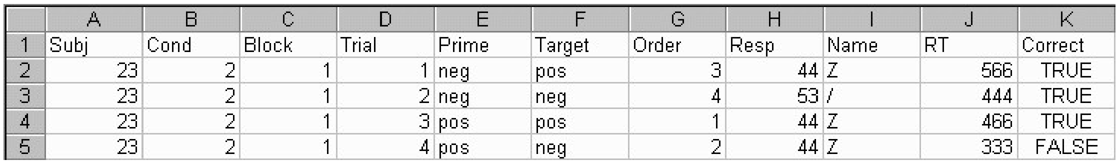
### With Optional Fields

However, you might want to create two optional fields to represent the two conditions. The first might be !Prime, and the second !Target, like this:



| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 1 | block | trial | !prime | !target | rbg | rwg | style |
| 2 | 1 | 1 | neg | pos | 1 | 1 | |
| 3 | 1 | 2 | neg | neg | 1 | 1 | |
| 4 | 1 | 3 | pos | pos | 1 | 1 | |
| 5 | 1 | 4 | pos | neg | 1 | 1 | |

This would result in a data file like this:

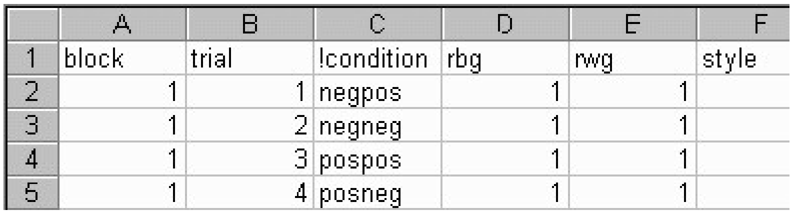


| | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Subj | Cond | Block | Trial | Prime | Target | Order | Resp | Name | RT | Correct |
| 2 | 23 | 2 | 1 | 1 | neg | pos | 3 | 44 | Z | 566 | TRUE |
| 3 | 23 | 2 | 1 | 2 | neg | neg | 4 | 53 | / | 444 | TRUE |
| 4 | 23 | 2 | 1 | 3 | pos | pos | 1 | 44 | Z | 466 | TRUE |
| 5 | 23 | 2 | 1 | 4 | pos | neg | 2 | 44 | Z | 333 | FALSE |

Won't that be easier to analyze?

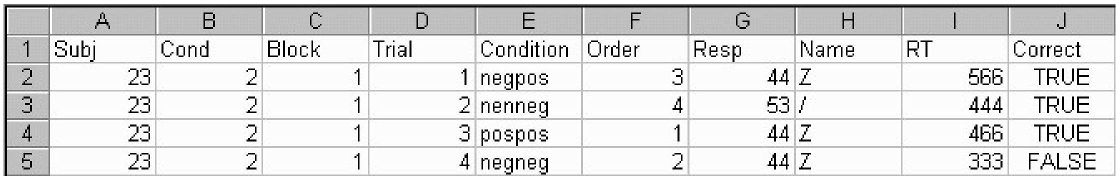
### Combining Optional Fields

Or alternately, you might combine them into a single Optional Field such as !Condition like this:



| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 1 | block | trial | !condition | rbg | rwg | style |
| 2 | 1 | 1 | negpos | 1 | 1 | |
| 3 | 1 | 2 | negneg | 1 | 1 | |
| 4 | 1 | 3 | pospos | 1 | 1 | |
| 5 | 1 | 4 | posneg | 1 | 1 | |

This would result in a data file like this:



| | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Subj | Cond | Block | Trial | Condition | Order | Resp | Name | RT | Correct |
| 2 | 23 | 2 | 1 | 1 | negpos | 3 | 44 | Z | 566 | TRUE |
| 3 | 23 | 2 | 1 | 2 | nenneg | 4 | 53 | / | 444 | TRUE |
| 4 | 23 | 2 | 1 | 3 | pospos | 1 | 44 | Z | 466 | TRUE |
| 5 | 23 | 2 | 1 | 4 | negneg | 2 | 44 | Z | 333 | FALSE |

## 3.6 RBG - Randomization Between Groups

### QuickInfo

**All trials sharing the same RBG value define a group to be kept together. If multiple groups are defined, then DirectRT will present the groups in a random order. Identical to the MediaLab function of the same name.**

### Value

Any positive integer value

### Details

You may wish to randomly order and present entire groups of trials in your questionnaire (e.g., randomizing which of four sets of 20 trials is presented 1st, 2nd, 3rd and 4th). To do this, assign the same RBG value in the bgr column to all of the items you want to keep together. For example, if you have five sets of ten trials and you want to randomize the order in which these 5 groups of trials are presented, then assign each group a different number and make sure all the items within each group share the same number for that group. The items within each group will all stay together, but the groups themselves will be randomly ordered. Items assigned a value of "0" or "none" in the rbg column will not move.

**Note that all items within a group must be sequential in the questionnaire.

Note for ease of analysis, trials are written to the data file in the order they occur in the input file, not in the randomized order in which they are presented. However an "Order" variable 52 is also written to indicate the sequential order in which the trials actually occurred.

### Example

See Samples, RBG 65

### See Also

RWG - Randomizing Within Groups 17

Using Random Values 38

## 3.7 RWG - Randomization Within Groups

### QuickInfo

**DirectRT will randomly order and present all items sharing the same RWG value. Identical to the MediaLab function of the same name.**

### Value

Any positive integer value

### Details

You may wish to randomly order and present trials within your questionnaire. To do this, assign the same RWG value in the wgr column to all the trials you want to have randomized with each other. For example, if you have five trials you want randomized, assign them each a "1". The five trials will be randomly presented in the five positions they occupy in the input file. All other trials will be presented in their normal positions as long as their RWG value is 0. You can independently randomize another group of items by assigning them all a "2", another group with "3's and so forth.

**Note that unlike the RBG method 17, items do not need to be sequential to be assigned the same RWG value.

Note for ease of analysis, trials are written to the data file in the order they occur in the input file, not in the randomized order in which they are presented. However an "Order" variable 52 is also written to indicate the sequential order in which the trials actually occurred.

### Example

See Samples, RWG 65

### See Also

RBG - Randomizing Between Groups 17

Using Random Values 38

## 3.8 Style

### QuickInfo

**The style code is a number that identifies a particular style (e.g., font, colors, rt parameters) for the trial. Styles are stored in a .DRT Styles file 39. Edit Styles files by double clicking on them, or open the Style editor 40 from the DirectRT main program window (select Edit->Style File)**

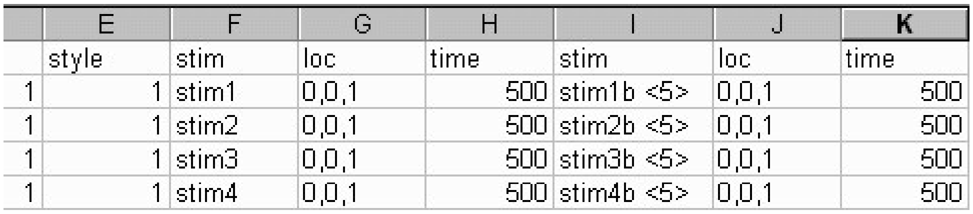
### Details

To save time, you can store font, color, alignment and miscellaneous RT information in a Styles (.DRT) file. Combinations of such variables can be created and saved with a single style code. In the style column of each trial, specify the style you want to use for the trial by using the numeric style code 42 from the Styles file you're using.

### Hints

You can (and probably should) have different Styles files for different experiments. You can copy, modify and rename any Styles file and locate it in the same folder as your input file-making it unique to the experiment you are currently working on. DirectRT will first look for a Styles file located in your experiment folder. If it doesn't find one, it will use the default "styles.drt" file in the main DirectRT program folder. Note that using the default Styles file can lead to unpredictable results if you change it for another experiment and then try the current experiment again. For this reason it's usually best to copy a Styles file to your experiment folder and modify it as needed for that particular experiment. This way, the styles will be unaffected by changes in the default settings. For example, you'll see that every sample folder has its own unique Styles file.

Another useful hint is that you can change styles in the middle of a trial. To change a style part way through a trial, put the style in the Stim column surrounded by < > like this:



| | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|
| | style | stim | loc | time | stim | loc | time |
| 1 | 1 | stim1 | 0,0,1 | 500 | stim1b <5> | 0,0,1 | 500 |
| 1 | 1 | stim2 | 0,0,1 | 500 | stim2b <5> | 0,0,1 | 500 |
| 1 | 1 | stim3 | 0,0,1 | 500 | stim3b <5> | 0,0,1 | 500 |
| 1 | 1 | stim4 | 0,0,1 | 500 | stim4b <5> | 0,0,1 | 500 |

In the above example, each of these trials starts out using Style 1 but switches to Style 5 for the second stimulus.

Note you can also switch style settings in the same way within any text file 22 you present (i.e., by placing style codes within the text).

### See Also

See more detailed information on Styles and the Style Editor 39

## 3.9 Stim - Stimulus

### QuickInfo

**The Stim column identifies a stimulus to be presented during the trial. For stimuli that are files (e.g., image, sound and text files), DirectRT expects the actual files to be in a "Stim" folder located in the same folder as the input file. If the files are located elsewhere, then the full path needs to be specified. Every Stim column needs a corresponding Loc and Time column.**

### Values

The following are the different stimulus types allowed in the Stim column. To tell DirectRT which type it is, you need to precede it with an identifying character as follows:

| ***Identifier*** | ***Stim Type*** | ***File Type*** | ***Function*** |
|---|---|---|---|
| none | Image 20 | *.bmp | Displays an image file |
| ! | Sound 20 | *.wav | Plays a sound file |
| _ | Video or Animation 21 | | Plays any file that can be viewed with the Windows Media Player |
| ~ | Text 21 | | Displays specified text or a blank screen if entered alone. |
| # | Text File 22 | *.txt | Displays the contents of a text file |

| | | | |
|---|---|---|---|
| & | StimList-Sequential 23 | *.txt | Selects next or specific stimulus from a list |
| % | StimList-TrueRandom 23 | *.txt | Randomly select stimulus from a list |
| $ | StimList-Random 23 | *.txt | Randomly selects stimulus from a list without replacement |
| = | Prior Response 24 | | Presents a prior response of the subject as a stimulus |
| ? | Prior Stimulus 24 | | Presents a prior stimulus from a specified trial |

### Image file

To present an image (.BMP) file, simply enter the name of the image file. Images are the default stimulus type so the filenames do not need to be preceded with a special character. Also you do not need to type the ".bmp" following the filename as it is assumed.

Notes about Image Files 25

### ! Sound File

To present a sound (standard PCM format .WAV) file, simply enter the name of the sound file preceded by a "!" (e.g., "!mysound"). You do not need to type the ".wav" following the filename as it is assumed. Note that the sound file should be located in the experiment's Stim folder. When using a sound file for a stimulus, you should enter a "0" in the Time column if you want DirectRT to play the sound and proceed immediately to the next stimulus. If you want a delay before the next stimulus occurs, then you should enter the length of that delay in the Time column in milliseconds. To use the default settings for sound files, enter "0,0,0" in the Location column.

#### *Advanced Options*

When playing sound files, you cans set options by using values other than "0,0,0" in the Location column. These three options are Frequency, Pan and Volume, respectively. To speed up or slow down the sound file, you can set the frequency in hertz (Hz) at which the sound is played by entering a value from 100 to 100000. To control whether the sound is dominant in the right or left channel, you can set a Pan value anywhere from -100 (left only) to 100 (right only). Finally, to control the volume at which the sound file is played, you can enter a value from 0 (normal) to -100 (completely muted). Sounds can only be reduced in volume and not amplified. Example: To play a wave file at 1500 Hz, in the left ear only, at half volume, you would enter "1500,-100,-50" in the Location column for the sound file stimulus.

#### *Hint*

If you have some other form of sound file (e.g., MP3) than a standard PCM formatted .WAV file, you can play it via the Windows Media Player engine by using the same _ symbol used for animations and videos (see below). As with motion image files, anything that will play in the Windows Media Player should be accessible through the _ function.

### _ Video / Movie / Animation File

DirectRT will display video (e.g., mpg, avi), animation (e.g., gif) and other files that contain visual motion. It will display them with a high degree of precision in both time and location on the screen. The easiest way to tell if DirectRT will play your file is to open the Windows Media Player (WMP) on your machine and try to run the file--if it plays then it should be fine with DirectRT. Note that newer versions of the Windows Media Player do not support QuickTime. QuickTime Pro converts mov files to avi and mpg if your files are already in this format.

To define a video or animation in your DirectRT session as a stimulus:

1. Copy the media file to your stim folder (recommended but not necessary)

2. Enter the name of the media file in a "Stim" cell

3. Use an underscore "_" to tell DirectRT it's a movie/animation.

4. Define the size of your video window in parentheses after the file name, e.g., (640x480). DirectRT will play the movie at a size of 640 pixels wide by 480 pixels high. You need to specify the movie size explicitly.

#### *Example*

If your movie is called "mymovie.mpg" then make sure it's in your stim folder and then refer to it in your input file as "_mymovie.mpg (320x240)"

That's it! You can also position the movie exactly as if it were an image using the location column. "0,0,1" will play it center screen. When applying a style to a trial with video, center alignment tends to work best. You can then take RTs in the time column, again just like it were a picture.

#### *Video Quality Trick*

By default, DirectRT runs in 16-bit colour mode. It does this because it gives the program a little extra boost of speed. This is great for text and images but not so great for video. If you're using video and you want the video to look its best, you'll want to run your session in full colour mode (24 or 32-bit).

To do this, create a simple text file called "colour.txt" (yes, the u is necessary :) and copy it to your experiment folder (i.e., the same folder as your input file). In the text file, simply type the number of colour-bits you'd like DirectRT to use. You can use the values 8, 16, 24 and 32. If DirectRT finds your colour.txt file then it will know you want a custom colour depth. If you use 24 or 32 then the video should play in full colour and look really nice. Your system may only support one or the other (i.e., 24 or 32 but not both) so you may have to try each, or check your display settings to see what is allowed.

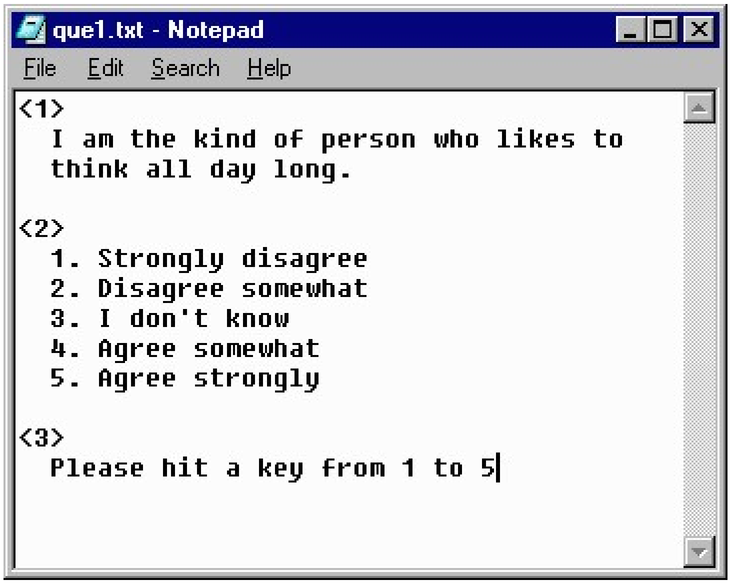
### ~ Text

To present a single string of text simply type the actual text you want to display preceded by a "~" Any single word or single line of text can easily be presented in this way. The text will be presented using the colours and font settings associated with the style code for that trial. A blank screen can be presented easily using the ~ symbol on its own.

If you want to present more than a single line of text on the same screen, you can use compound screens (see samples), more simply, you can request a text file instead.

### # Text file

To present more than a single line of text on the same screen you can enter the name of a text file to be used as a stimulus. To display the contents of a text file, type the name of the text file preceded by a "#" You do not need to type the ".txt" (it is assumed) although it will not affect anything if you do. Also, you can embed style codes 39 within a single text file for multiple font and colour formats. In the example below, different styles are used for the question wording (style 1), responses (style 2), and page footer (style 3). You can also place style codes in the middle of a line of text (e.g., to change the color or italics of a font). If you do use multiple style within a text file, DirectRT will use the first background colour it encounters (i.e., additional styles will not change the initial screen colour). Text files will always be located starting from the top left corner of the screen. Left and top margins are achieved with spaces and hard returns, respectively.



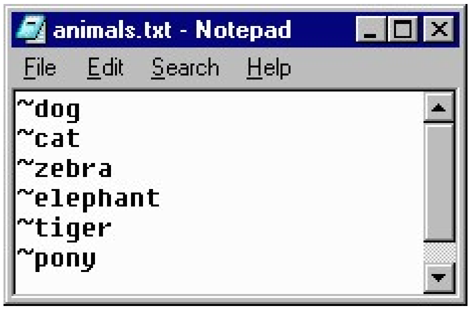
```
<1>
  I am the kind of person who likes to
  think all day long.

<2>
  1. Strongly disagree
  2. Disagree somewhat
  3. I don't know
  4. Agree somewhat
  5. Agree strongly

<3>
  Please hit a key from 1 to 5
```

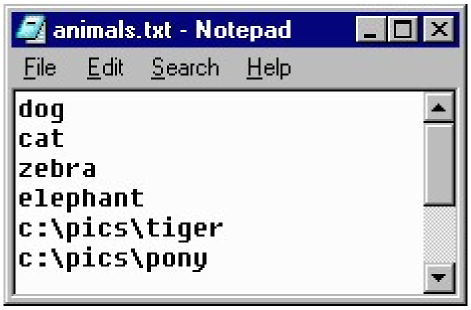
### StimLists

Rather than specifying a specific stimulus, you can opt to request that the stimulus be chosen from a stimulus list. StimLists are text (.txt) files that you create with any text editor that simply list stimuli. This can be especially handy if you want to randomize the stimuli that fill particular positions in your input file (e.g., as opposed to or in addition to randomizing the order of trials-see Randomizing Trials 17). The list can include any stimuli you could identify normally (e.g., text, images, text files). Just specify all the stimuli the same way you would as if you were entering each directly in the Stim column. For example, the following depicts a simple StimList with a series of Text stimuli:



```
~dog
~cat
~zebra
~elephant
~tiger
~pony
```

In the next example, this StimList contains a series of images located in the Stim folder and then two images located in another folder.



```
dog
cat
zebra
elephant
c:\pics\tiger
c:\pics\pony
```

### *Selecting Stim from a StimList*

The symbols $, %, and & each indicate a StimList. The difference between them is in how DirectRT selects the stimulus from those listed in the file. The three types of stimulus selection are: Sequential, TrueRandom, and Random.

### *& Sequential*

The & symbol indicates that you want DirectRT to display the first stimulus in the list and then each subsequent stimulus whenever it comes across this StimList again. For example, if you were using the list of animals above, every time you entered &animals in the Stim column of your input file, the next animal in the list would be displayed. If all the stimuli are presented, then DirectRT will begin again from the start of the list.

With the sequential selection type, you also have the option of calling a specific stimulus from the list. To do this, follow the name of the StimList with a ^ and the ordinal position of the stimulus in the list. For example, in the list of animals above, to present "zebra" you would enter &animals^3, or for tiger you would enter &animals^5. Note that doing so sets the sequential position of the file to that chosen item. If you do not specify a specific item the next time you call the file, it will continue from that point.

### *% TrueRandom*

The % symbol indicates that you want DirectRT to display a randomly chosen stimulus from the list. TrueRandom refers to the fact that each time DirectRT chooses a random stimulus it is unconditional. This means that the next stimulus chosen from the list could also have been the last.

### *$ Random*

Finally, the $ symbol indicates that you want DirectRT to randomly choose a stimulus from the list and then take that item out of the running for future selection unless all of the items are first used up. This is how you get randomization without duplicating what is presented or, as it's often called, randomization without replacement. Only if all of the item on the list have been displayed, then DirectRT will re-randomize the list and start again.

Note if for some reason you want to re-set the randomization before all the stimuli have been displayed, the easiest way to do this is to is to call a different StimList with identical stimuli.

### *Hints*

When the stimulus is a file and the file itself is located in a "Stim" folder in the same location as the input file then you can simply enter the name of the file in the Stim column. If the file is located in a subfolder within the Stim folder, then you can enter the name of the subfolder followed by the name of the file (e.g., images\myimage). Otherwise, you need to specify the full path and name of the file you want to present (e.g., c:\mypictures\myimage).

The advantage of placing the stimulus files in the Stim folder (or a subfolder) is that the folder containing the input file(s) and Stim folder can then be moved to a different place and you won't have to worry about checking path names (e.g., c:\..., d:\..., etc.)

## Advanced Stimulus Features

### = Using a Subject's Response as a Stimulus

Another special case can occur when you want to use the subject's own response as a stimulus. This could happen for example, if the subject were asked to type in a word, and then you wanted to use that word as a stimulus. To present a response as a stimulus, simply use "=" followed by the trial ID in the Stim column. When DirectRT gets to that trial it will substitute the prior response as the new stimulus. You can use the standard operators (e.g., ~, #, $, %, etc.) to indicate what type of stimulus it is, e.g., "~=4" means present the response from trial 4 as text.

For example, on trial 4 the subject enters their name, "George". Later on trial 10, you want to use that response as a stimulus. In the Stim column for trial 10, you could enter "~=4". This would tell DirectRT to present the response from trial 4 as a text stimulus on trial 10.

See sample: open ended responses as stimuli 70 in the "other features" sample folder

If you want to get really fancy with this, you can name image, sound, and stimlist files with the possible responses to a question and then have them presented using this feature. For example, if the possible responses to trial 4, are "a", "b" and "c", you could create stimlists called "a.txt", "b.txt" and "c.txt". Then later if you specified a stimulus as "$=4", DirectRT would substitute the response here from trial 4. So if the subject had responded with "b" to question 4, using a later stim value of "$=4" would mean "$b", in other words, randomly select a stimulus from stimlist "b.txt". The same logic applies to all file types that you can specify as a stimulus.

### ? Using Randomly Selected Stimuli Again

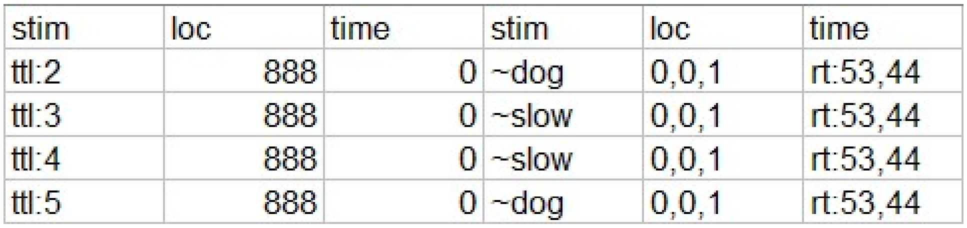
In special cases you might want to instruct DirectRT to use a stimulus from a previous trial without knowing exactly what that stimulus will be when you design your input file. This could happen for example, when a stimulus is randomly determined on one trial but then you want to repeat that trial. On the later trial you can simply tell DirectRT which stimulus you want to repeat. Essentially saying, "use the third stimulus from block 2, trial 5--whatever it was!" To do so, you can use the "?" operator which means to use a previous stimulus, no matter whether it was randomly chosen or not. To refer to a previous stimulus, you just need to know the block (b), trial (t) and stimulus (s) ID. For example if you want to use block 1, trial 3, stimulus 4 in a later trial, you would request: "?b1t3s4" in the stim column.

See sample: using previous stim 81 in the "other features" sample folder

### ttl Sending Synchronized TTL Signals to External Equipment

In order to communicate with external equipment (e.g., physiological equipment, response boxes, other computers), you can send and receive TTL (Transistor-Transistor Logic) signals through any of your computer's accessible ports (e.g., parallel or serial ports). In English, this means you can ask DirectRT to send a value from 0-255 to your external equipment any time you like, and/or you can have DirectRT wait for any value from 0-255 to come from the external equipment. To accomplish sending a value, you list a TTL signal just like any other stimulus in the Stim column of your input file. See the example below. We indicate that we want a TTL signal to be sent by entering "ttl:n" in the Stim column where n is the byte value from 0-255 that we want to send. We enter the port ID in the Loc column (e.g., 888 is usually the LPT1 parallel port). Finally, we enter a 0 in the Time column if we want to send the value and forget about it. Alternatively, we could specify the number of milliseconds here that we want the signal to be sent before setting the port back to its origional state.

So what happens in this example? On each of these trials, DirectRT will send the value (e.g., 2, 3, 4 or 5) to port 888 and then immediately proceeds with the next stimulus. Any external equipment that can read the byte value located at port 888 will now be able to know precisely when DirectRT displayed each of the subsequent stimuli.



| stim | loc | time | stim | loc | time |
|---|---|---|---|---|---|
| ttl:2 | 888 | 0 | ~dog | 0,0,1 | rt:53,44 |
| ttl:3 | 888 | 0 | ~slow | 0,0,1 | rt:53,44 |
| ttl:4 | 888 | 0 | ~slow | 0,0,1 | rt:53,44 |
| ttl:5 | 888 | 0 | ~dog | 0,0,1 | rt:53,44 |

See sample: TTL Signals 88 in the "other features" sample folder

For details on receiving TTL signals for response times, see the TTL signals sample.

### See also

Loc - Stimulus Location

Time

## 3.10 Notes About Image Files

### BMP vs. JPG & GIF

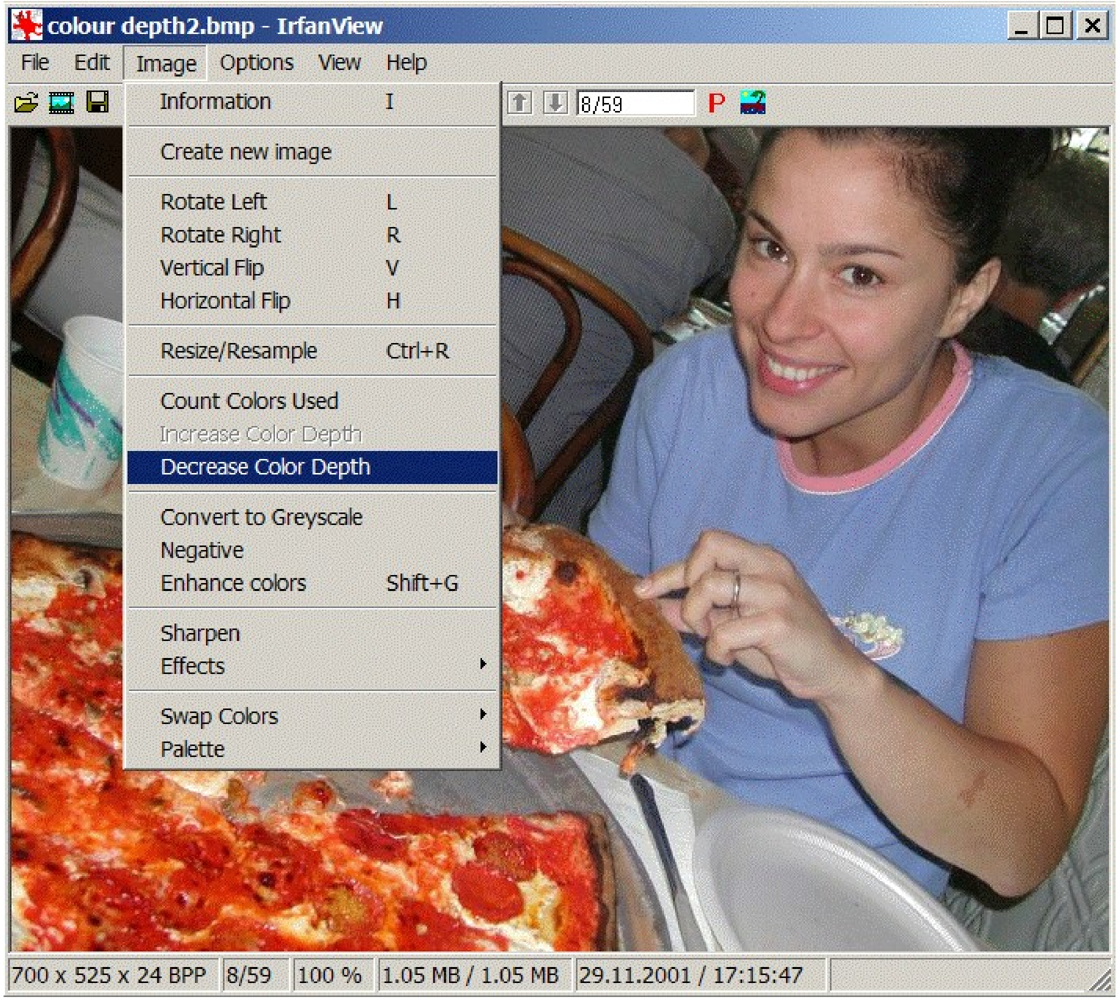
DirectRT uses bitmap (.BMP) images. The reason is that bitmap images are not compressed the way jpeg or gif files are. What's so good about that?! Yes it means bigger files taking up more hard drive space; your pain is felt. The benefit is SPEED. Because bitmap files are not compressed, they do not need to be DE-compressed prior to their display. This hastens things up considerably.

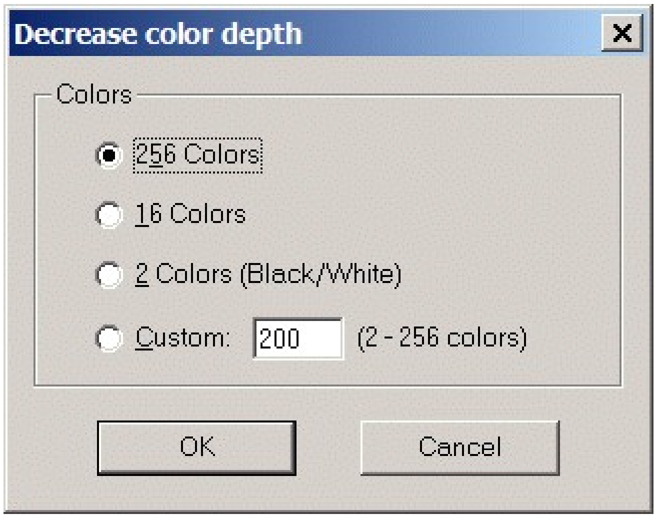
### 8-Bit, 256 Colours vs. 24-Bit, Millions of Colours

You can further ease the processing load on your computers by converting your images to 8-bit (256 color) depth. This will cut your file size down by two thirds! This can be done with little loss of image quality. If you don't have a utility for doing this, there is a freeware program called IrfanView that does a great job. Find it at http://www.irfanview.com/.

With IrfanView, to convert from 24bit to 8bit color (see Figure):

- Open the image, from the Image Menu, select Decrease Color Depth
- Select 256 colors and save your image. Check the difference in file size!




Decrease color depth

Colors

● 256 Colors

○ 16 Colors

○ 2 Colors (Black/White)

○ Custom: 200 (2 - 256 colors)

### Using Fireworks

You can always use text and text files for presenting instructions. However, sometimes, you may want more control over formatting. In such cases, you can create instruction screens with your favorite image editor and save the results as a .bmp image file. Many of the samples use instruction screens that were created with a program called Fireworks produced by Macromedia (e.g., Open Ended Responses[69]). The text for the instruction screens is easily formatted in Fireworks and then saved as a .bmp image in the experiment's stim folder. Some sample Fireworks source files (.png) are located in the IAT sample's stim folder. Fireworks files can be easily created and edited by downloading the trial version:

https://creative.adobe.com/products/fireworks

Simply open the corresponding .png file in Fireworks and edit the text. To save your changes as an image file, select "Export" and choose to save it in the .bmp image format. Fireworks is a great program for creating high quality text-based images.

### Creating Graphics with PowerPoint

The Priming with Images[69] sample illustrates how you can use PowerPoint to create graphics to use in your DirectRT session. To do this follow these steps:

- Set your system's display settings to match the screen resolution in which you'll be running your DirectRT session (e.g., 640x480, 800x600, 1024x768).
- Run your PowerPoint show *at this resolution*.
- For each screen, when it appears, press PrintScreen. Press Esc to stop the show and minimize PowerPoint.
- Open your graphics application and select Paste. The screen image will be pasted into your graphics application as a graphic.
- Save the image as a .bmp file. Remember that DirectRT can process the image much faster if you save it in 8-bit or 256 colors.

### From Other Windows

You can also capture the contents of any open window as a graphic by pressing Alt-PrintScreen. By pressing Alt when you hit PrintScreen, you limit the graphic to the currently active window. Hitting PrintScreen alone capture the entire screen. Then, open your graphics application and Paste the image and edit it as necessary.

### Creating scales

Creating scale images with ticks and equal distances between the ticks can be tricky in standard graphics applications. The scale image used in the Assessing Modern Racism[69] sample was done as follows:

- Start Excel or another spreadsheet application.
- Select all the cells and choose a color fill (e.g., black).
- Select all the cells and select a fairly thick color border (e.g., yellow).
- Select a common column width according to how far apart your scale points should be graphically.
- Use the Alt-PrintScreen method described above to capture the window as a graphic.

- Paste the image into any graphics editor and trim the excess away leaving your scale and tick marks.
- Add text labels as desired and save.

## 3.11 Loc - Stimulus Location

### QuickInfo

**Specifies where the stimulus is to be located on the screen and whether to add the stimulus to the previous screen or start a fresh screen. Consists of three numbers separated by commas: Horizontal, Vertical, Clear**

### Common Values:

0,0,1 = center the stimulus, clear the previous screen

0,0,0 = center the stimulus, add it to the previous screen

Remember values of 0 for Horizontal and Vertical mean center-screen.

### Details

The purpose of the Horizontal and Vertical values is to define a single point on the screen. DirectRT uses this point combined with the Align 44 property of the current style to figure out where to place the stimulus. If Align is set to Center, then the point defines the Center of the stimulus. If Align is set to Left, then the point defines the top, left corner of the stimulus. Finally, if Align is set to Right, then the point defines the top right corner of the stimulus.

### Horizontal

The first of the three numbers is the number of pixels from the left of the screen. Optionally, a value of 0 indicates the horizontal center of the screen. Values can also be entered as a percentage, e.g., .3 would place the point 30% of the way across the screen from its left side.

Note: Where the stimulus is actually placed depends on the current Style setting 18 for that trial. Every style has an alignment property 44 of Left, Center, or Right. If the alignment setting of the current style is left, then the left point specified

### Vertical

The second number is the number of pixels from the top of the screen. Optionally, a value of 0 indicates the vertical center of the screen. Values can also be entered as a percentage, e.g., .3 would place the point 30% of the way down from the top of the screen.

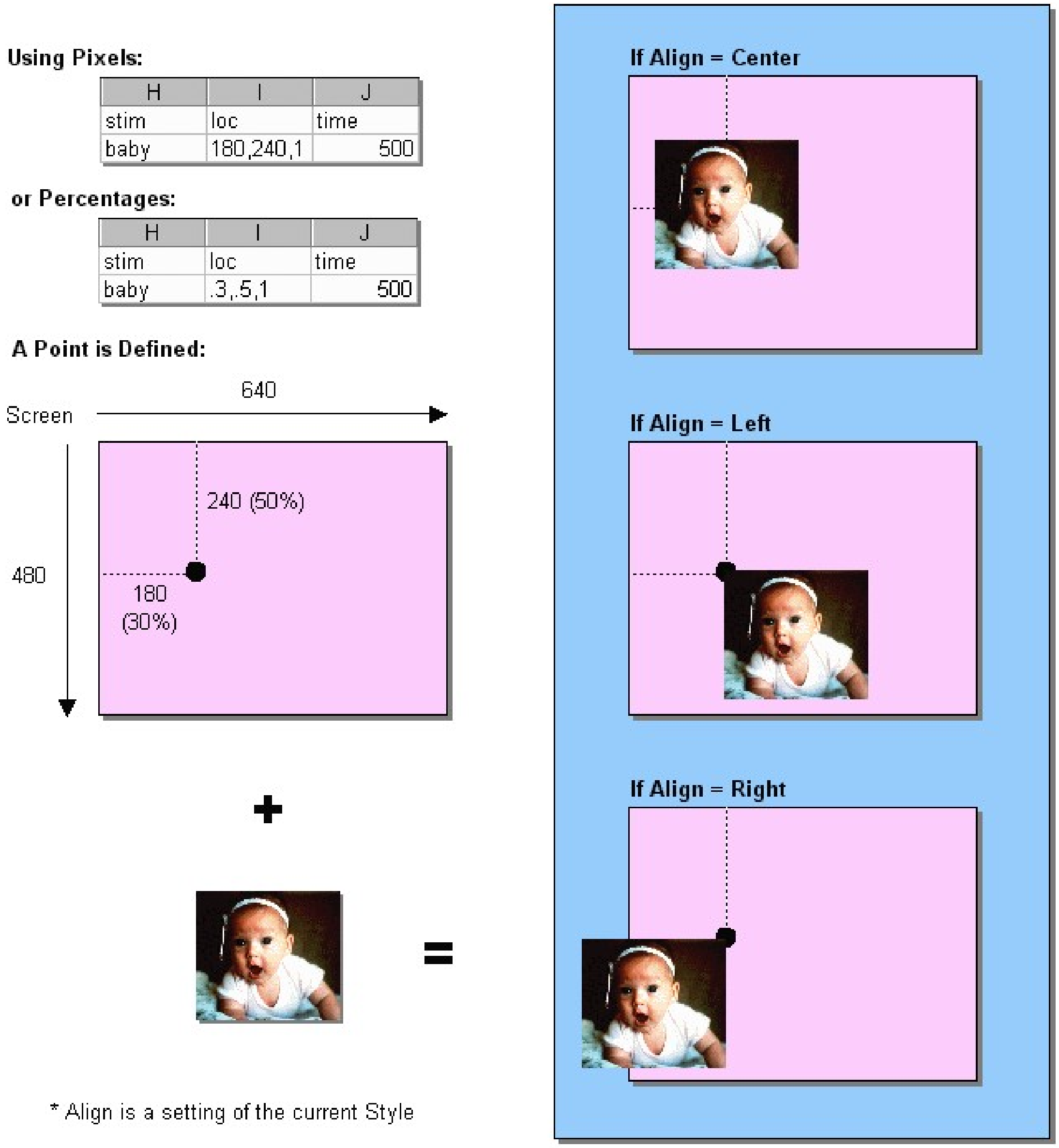
### Clear

The third number indicates whether to add the stimulus to the previous screen (0) or to clear the previous screen and place the stimulus on a fresh screen (1). See also: Clear Screen During an RT 78.

## About Pixels

Although DirectRT will work in a number of screen resolutions, how things look will depend on the resolution you choose. Certain items may need to be repositioned with the Left and Top parameters when running in high resolution modes. What do the Left and Top numbers mean? If you are running your session in 640x480 mode then the width of your screen is 640 pixels and the height is 480 pixels. This means that a 640x480 image will fill the screen in this mode. In 800x600 mode, the screen is 800 pixels wide and 600 high and will not be filled with a 640x480 image. You can change the screen resolution your session runs in by selecting Options in the Style Editor.

## Example



Using Pixels:

| H | I | J |
|---|---|---|
| stim | loc | time |
| baby | 180,240,1 | 500 |

or Percentages:

| H | I | J |
|---|---|---|
| stim | loc | time |
| baby | .3,.5,1 | 500 |

A Point is Defined:

* Align is a setting of the current Style

### Special Values for Sound Files

For the special case where you are using a sound file as a stimulus, the location values take on different meanings. To use the default values, simply enter "0,0,0" in the Location column. However, you can set options by using values other than "0,0,0"--these three options are Frequency, Pan and Volume, respectively. To speed up or slow down the sound file, you can set the frequency in hertz (Hz) at which the sound is played by entering a value from 100 to 100000. To control whether the sound is dominant in the right or left channel, you can set a Pan value anywhere from -100 (left only) to 100 (right only). Finally, to control the volume at which the sound file is played, you can enter a value from 0 (normal) to -100 (completely muted). Sounds can only be reduced in volume and not amplified. Example: To play a wave file at 1500 Hz, in the left ear only, at half volume, you would enter "1500,-100,-50" in the Location column for the sound file stimulus.

### Special Value for TTL Signals

For the special case where you are sending a TTL signal as a stimulus, the value of the Loc column should be the port address (in Decimal) to which you want the TTL signal sent (e.g., 888 is commonly used to identify the LPT1 parallel port). To help identify ports and port IDs, you can run the IOTest utility from the DirectRT Tools menu (...\DirectRT\TTL \IOTest.exe). Note that users on Windows 2000/XP machines may have to be logged on with administrator rights to work with TTL functions.

## 3.12 Time

### QuickInfo

**Specifies how long the stimulus is to remain on the screen in milliseconds OR tells DirectRT to wait for a specified input event (e.g., keypress, mouseclick, joystick event, microphone input, TTL signal).**

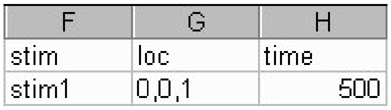
### Values

The Time column can be used to specify 1) a stimulus duration in milliseconds or 2) that a response is required.

### Details

### Specifying a Stimulus Duration

Enter any integer value to specify the number of milliseconds for which the stimulus will be displayed. For example, to display the stimulus "stim1" for 500 milliseconds before the next stimulus were displayed type 500 into the time column cell immediately following the stim column cell for "stim1":



| F | G | H |
|---|---|---|
| stim | loc | time |
| stim1 | 0,0,1 | 500 |

Advanced Hint: You can create a "Compound-Screen 63" by using a Time value of 0 for the current stimulus and a Clear value of 0 28 in the Loc column for the subsequent stimulus. Using a Time value of 0 tells DirectRT that you don't want to display the stimulus alone. DirectRT will then take the subsequent stimulus and put it on the SAME screen for display at the same time (i.e., with no delay in between). Just make sure you don't request a clear screen (i.e., a Clear value of 1) for the subsequent stimulus! In fact, you can place as many stimuli on a single screen at one time as you like using this method.

Note about sound files: Sound files are always played to their completion. For sound files, the stimulus presentation time represents the number of milliseconds that DirectRT should wait after starting the sound before presenting the next stimulus. For example, if you wanted to play three sound files, each starting one second after the other, then you would use a time value of "1000" for each. To have them all play simultaneously, you would use a value of "0" for each. Note: When playing multiple sound files "simultaneously", DirectRT will start each sound sequentially with as little delay as possible given your system's processing capabilities.

### Specifying that a Response is Required

In addition to specifying the duration of a stimulus, you can use the Time column to indicate that a response is expected before continuing. The kinds of responses you can request are:

KeyPresses, MouseClicks, and Discrete JoyStick Motions 31

Request a short open ended response 69

Record a voice response and reaction time via the microphone 85

Record continuous joystick movement for a specified duration 73

Wait for TTL signal from an external device (version 2002.3 and later) 88

Collect multiple response times per trial 79

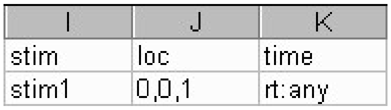
Record KeyRelease time in addition to subsequent KeyPress time 77

Require Correct Response (e.g., IAT) 75

Response Feedback (display subject's response on screen) 79

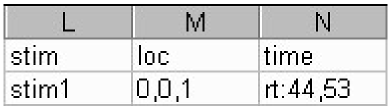
### KeyPresses, MouseClicks, and Discrete JoyStick Motions

Enter "rt:" followed by any number of valid key, mouse or joystick codes (see below for a list of valid keys and their corresponding code numbers). For example, typing "rt:any" in the time column cell after the stim column cell for a stimulus named "stim1" would instruct DirectRT to wait for participants to press any key after the display of stimulus "Stim1":



| I | J | K |
|---|---|---|
| stim | loc | time |
| stim1 | 0,0,1 | rt:any |

As another example, typing "rt:44,55" in the time column cell after the stim column cell for a stimulus named "stim1" would instruct DirectRT to continue only if the subject hit the "Z" key (code 44) or the "/" key (code 53).



| L | M | N |
|---|---|---|
| stim | loc | time |
| stim1 | 0,0,1 | rt:44,53 |

See the codes table below for allowing specific responses. You can list as many codes as you like. However, when assessing response accuracy, the first key code defines the "correct" response. Thus, the "Correct" column of the short data file[52] will record a value of "TRUE" if the first defined key is pressed. If the key pressed by the subject is any of the other keys besides the first one listed then the "Correct" column in the data file will record a value of "false".

In addition to the specific key codes, other allowable keypress events are:

- **any** = any key
- **num** = any number key on the regular keyboard
- **numpad** = any number on the number pad
- **alpha** = any character of the 26-character alphabet
- **funct** = any function key

### Common Key Codes

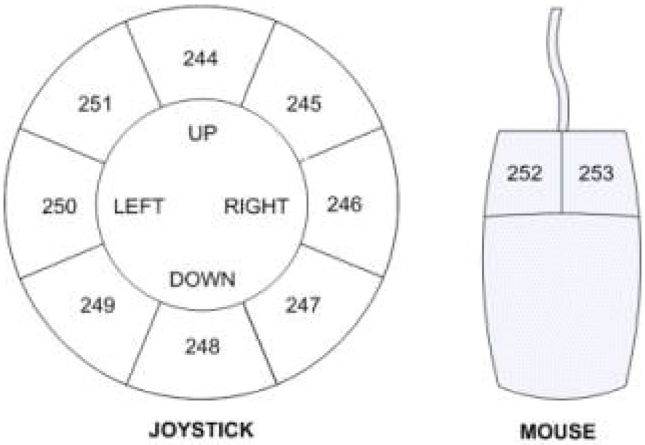
| Key | Code | Key | Code | Key | Code | Key | Code | Key | Code | Key | Code |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | Pad1 | 79 | F1 | 59 | A | 30 | N | 49 | Enter | 28 |
| 2 | 2 | Pad2 | 80 | F2 | 60 | B | 48 | O | 24 | Space | 57 |
| 3 | 3 | Pad3 | 81 | F3 | 61 | C | 46 | P | 25 | lShift | 42 |
| 4 | 4 | Pad4 | 75 | F4 | 62 | D | 32 | Q | 16 | lCtrl | 29 |
| 5 | 5 | Pad5 | 76 | F5 | 63 | E | 18 | R | 19 | lAlt | 56 |
| 6 | 6 | Pad6 | 77 | F6 | 64 | F | 33 | S | 31 | rShift | 54 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 7 | Pad7 | 71 | F7 | 65 | G | 34 | T | 20 | rCtrl | 157 |
| 8 | 8 | Pad8 | 72 | F8 | 66 | H | 35 | U | 22 | rAlt | 184 |
| 9 | 9 | Pad9 | 73 | F9 | 67 | I | 23 | V | 47 | ; | 39 |
| 0 | 10 | Pad0 | 82 | F10 | 68 | J | 36 | W | 17 | ' | 40 |
| | | | | F11 | 87 | K | 37 | X | 45 | , | 51 |
| | | | | F12 | 88 | L | 38 | Y | 21 | . | 52 |
| | | | | | | M | 50 | Z | 44 | / | 53 |

### Less Popular But Still Loved

| Key | Code | Key | Code | Key | Code |
|---|---|---|---|---|---|
| - | 12 | Home | 199 | PgDn | 209 |
| [ | 26 | Insert | 210 | PgUp | 201 |
| ] | 27 | Left | 203 | Right | 205 |
| ` | 41 | LWin | 219 | rWin | 220 |
| = | 13 | NumLock | 69 | ScrollLock | 70 |
| Apps | 221 | PadCom | 91 | SysRq | 183 |
| Backspace | 14 | PadDec | 83 | Tab | 15 |
| CapsLock | 58 | PadDivide | 181 | Up | 200 |
| Delete | 211 | PadEnter | 156 | | |
| Down | 208 | PadMinus | 74 | | |
| End | 207 | PadMult | 55 | | |
| Esc | --- | Pause | 116 | | |

## Joystick & Mouse Codes



| Joystick | Code | Mouse | Code |
|---|---|---|---|
| Button 1 | *241* | Left-Click | *252* |
| Button 2 | *242* | Right-Click | *253* |
| Button 3 | *243* | Mid-Click | *254* |
| Up | *244* | Other-Click | *255* |
| Up-Right | *245* | | |
| Right | *246* | | |
| Down-Right | *247* | | |
| Down | *248* | | |
| Down-Left | *249* | | |
| Left | *250* | | |
| Up-Left | *251* | | |

Note about joystick codes: You must first make sure your joystick is set up to work with Windows programs. You can set up your joystick by selecting "Gaming Options" or "Joystick" in the Windows Control Panel. You might need to "add" your joystick if you do not see it currently configured there. When you check this, it's also a good idea to calibrate your joystick using the calibration utility provided by Windows. The movement codes above (i.e., 244-251) are triggered as follows: DirectRT divides the joystick range into 8, 45 degree angles (like cutting a pizza into 8 slices). As soon as the joystick has moved more than half of it's range in any direction, DirectRT determines which of the 8 "slices" the joystick is in and takes that as the response and records the RT at that point. See also: Continuous Joystick Capture 73.

Note about mouse codes: You may choose to have subjects respond with mouse clicks rather than key presses. This can easily be done with the mouse codes above. Note that you will not see the mouse cursor.

### See also

Using Key Codes in the Time [30] Column.

### See also:

MinMax [45] settings for options involving automatic continuation, fixed stimulus display intervals with an RT, clearing the stimulus before a response has occurred, allowing no response as an option, etc.

### Other Response Methods and Features

In addition to the traditional codes, DirectRT provides a number of other response methods and features. Because  a number of these methods involve rather lengthy explanations, we will refer you to an illustrative sample for each one that fully explains the feature and simultaneously provides a concrete demonstration.

Request a short open ended response [69]

Record a voice response and reaction time via the microphone [85]

Record continuous joystick movement for a specified duration [73]

Wait for TTL signal from an external device

Collect multiple response times per trial [79]

Record KeyRelease time in addition to subsequent KeyPress time [77]

Require correct response (e.g., IAT) [75]

Response feedback (display subject's response on screen) [79]

Use a fixed response time window [45]

Clear screen while waiting for an RT [78]

## 3.13 Skipping

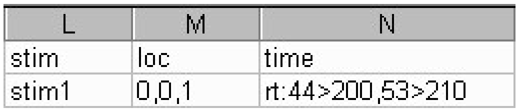
### QuickInfo

**Skipping allows a participant to skip to a later specified trial based on their response to an earlier trial.**

### Details

Whenever you allow for an RT [31], you can assign a "skip" value for any of the key codes that are allowed as a response. To do this, simply follow the keycode with a ">" and the trial ID [15] that DirectRT should skip to in the event that that key is pressed.

For example,



| L | M | N |
|---|---|---|
| stim | loc | time |
| stim1 | 0,0,1 | rt:44>200,53>210 |

In this case, you have allowed the subject to hit either the Z (code 44) or the / (code 53) key in response to stim1. You have also told DirectRT that if the subject hits the Z key then you want them skipped to trial 200, and that if they hit the / key, then they should be skipped to trial 210.

Note that the way DirectRT does this is that it literally skips through the trials in the input file looking for the requested trial ID. If it is found, then the trials resume with the requested skipped to trial. If not, the session ends. You can use this to intentionally end a session at any point during your input file (e.g., rt:any>9999).

Also note that skip patterns work on the basis of the trial ID column (the one you fill in) and not the sequential position of the trial (i.e., the row in the spreadsheet).

### Unconditional Skipping

In some cases you may want to skip over items unconditionally. Unconditional skipping is especially useful for rejoining subjects who have been conditionally skipped to various points in the input file so that they end up at a common place. When they are done their special sections, they can be joined up to the same trial by putting an unconditional skip item at the end of each of their custom sections. In each case they are all skipped to the same trial and continue on with the same set of items.

The command is the same as above but this is a useful concept that is sometimes overlooked. Essentially, it means that you skip the subject to the same later trial NO MATTER WHAT key they press. For example, by typing

rt:any>210

OR

rt:44>210,53>210

in the time column of a trial would tell DirectRT to skip to the trial with ID 210 no matter what identified keypress occurred.

### Advanced Hint

If you have stimuli following the skip command on the same trial, DirectRT waits until the end of the trial to skip. If you want a skip to be executed mid-trial then assign a negative value to the trial ID. For example, to break out of a trial immediately and skip to trial 100, you could rt:44>-100,53>-100. Any subsequent stimuli on the trial would be ignored.

Combining Unconditional Skipping with RWG (Randomization Within Groups) 17 creates a very useful randomization technique. With this technique you can not only randomly order your trials, but you can randomly determine which trials your subject gets. Imagine you have created 100 trials and you want DirectRT to randomly choose 50 of these trials and then present them in a random order. First, assign all 100 trial you wish to possibly be one of the 50 randomized trials an RWG value of 1. Then, the trick is to stick a trial in the middle-right after the fiftieth of the 100 trials-and give it an RWG value of 0. That means it's position is fixed. In this trial, assign an unconditional skip to-something like "rt:any>101," assuming that a trial with 101 as the ID comes after the 100 trials you are trying to randomize. Any response will skip the subject over the next 50 items. Done!

You can do this with any set of items located anywhere in your input file. Just assign them all the same RWG value and then place an unconditional skip anywhere in the middle that takes the subject beyond the remaining items in the same RWG set. The earlier you place it, the smaller the random sample of items from the group.

Note that this is just the start. If you want to get really fancy you can do the same with RBG (Randomize Between Groups) 17 and in so doing, randomly select and administer entire blocks of items from within the same input file. And of course you can combine all of these concepts together for one extremely randomized experiment.

### See also

Jumping 37

## 3.14 Jumping

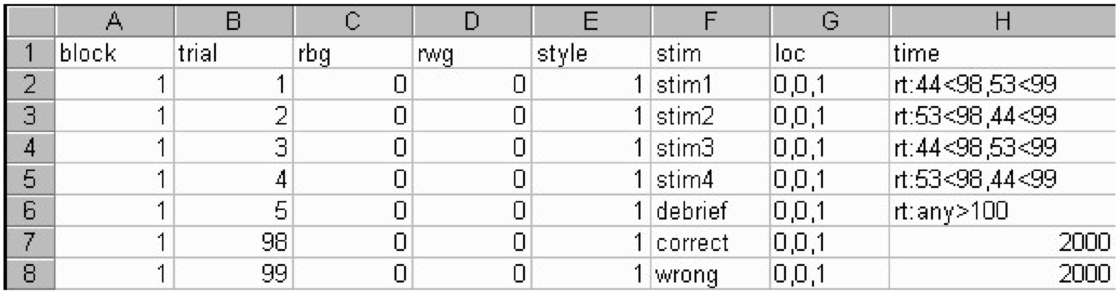
### QuickInfo

**Jumping is just like skipping 35 except that you come back.**

### Details

As with skipping, jumping allows you to go off and run one trial of your choosing depending on the response a subject gives. Instead of continuing from the later trial as with skipping, using jumping makes DirectRT return to the fist trial and resume from the trial right after it. This is a convenient way to give feedback and to execute other conditional events that are based on a subject's response.

The command works exactly the same way as the skip command except the arrow goes toward the keycode (i.e., <) instead of away from it (i.e., >). In the example below, each of the allowable responses in trials 1 through 4 is assigned a jump value:



| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 1 | block | trial | rbg | rwg | style | stim | loc | time |
| 2 | 1 | 1 | 0 | 0 | 1 | stim1 | 0,0,1 | rt:44<98,53<99 |
| 3 | 1 | 2 | 0 | 0 | 1 | stim2 | 0,0,1 | rt:53<98,44<99 |
| 4 | 1 | 3 | 0 | 0 | 1 | stim3 | 0,0,1 | rt:44<98,53<99 |
| 5 | 1 | 4 | 0 | 0 | 1 | stim4 | 0,0,1 | rt:53<98,44<99 |
| 6 | 1 | 5 | 0 | 0 | 1 | debrief | 0,0,1 | rt:any>100 |
| 7 | 1 | 98 | 0 | 0 | 1 | correct | 0,0,1 | 2000 |
| 8 | 1 | 99 | 0 | 0 | 1 | wrong | 0,0,1 | 2000 |

Trials 98 and 99 are images 20 that convey the subject was correct or wrong in their response, respectively. Using a value of 2000 in the time column cell of trials 98 and 99 tells the jump trial to display the image for 2000 ms, after which the trials resume from where the jump initiated.

Note that you will likely want to insert an Unconditional Skip 36 just before these feedback screens so that they are not displayed on their own. In the example above, a debriefing trial occurs on trial 5 in which time any keypress will skip subjects over the feedback trials to trial 100.

### Advanced Hint

If you have stimuli following the jump command on the same trial, DirectRT waits until the end of the trial to jump. If you want a jump to be executed mid-trial then assign a negative value to the trial ID. For example, To break out of a trial immediately and jump to trial 100, you could indicate rt:44<-210,53<-210. Subsequent stimuli on the trial will be ignored.

## 3.15 Using Random Values

### Generating Random Values

In some cases you may want to generate random values within your input file. For example, you might want DirectRT to generate random display times 30, a random location 28, a random filename and so on. Until now, randomization has required stimulus lists 22 or trial order arrangement to achieve these kind of results. DirectRT now gives you two fun new randomization methods.

### Random Number Within a Range

To have DirectRT generate a random value within a numerical range, simply request it using the rand() keyword, and indicate the minimum and maximum values in parentheses, separated by a dash like this:

rand(min,max)

For example, if you want an image displayed for a random duration within the range of 500 to 2000 milliseconds, simply enter rand(500-2000) in your Time column. DirectRT will find this request and replace it with a random integer value between 500 and 2000.

### Random Value from a List

To have DirectRT randomly pick one value from a list, simply request it using the rand() keyword, and indicate the choices in parentheses, separated by commas:

rand(choice 1,choice 2,choice 3,...,choice n)

For example, if you want an image displayed for a random interval of either 500, 1000, 1500, or 2000 milliseconds, simply enter rand(500,1000,1500,2000) in your Time column.

You could also choose a random stimulus this way:

rand(~cat,~dog,~frog)

Note that the rand() keyword can take up a whole cell like in the examples above or it can make up just part of a cell:

~Please count to rand(1-100) out loud

Or, to pick from a set of images:

C:\image\imagerand(1,2,12,17,33).bmp

### How it Works

Both work by inserting a special keyword "rand()" into your input file. Before doing anything else, DirectRT will scan your input file for this keyword and generate random values wherever you've asked for it to do so. You can request this *anywhere* in your input file. It will generate the random value as requested and replace the request with the randomized value. DirectRT will then save the results as a new input file--it will share the same name as the original file but will have the subject ID appended to it. So if your file is called "myfile.csv" and your subject ID is 22, then the new input file will be called "myfile_22.csv" and this is the file that DirectRT will run.

In fact, this is a good way to check if you're getting the randomization values you want--after the session, you can open the revised input file and see the actual random values that DirectRT generated. The log data file will also be a good source of information on what random values were generated.

# 4 Style Editor

## 4.1 About Styles and the Style Editor

Main Style Window 40

Style Menu Commands 41

Options Window 47

### Overview of Styles

The purpose of styles is to save you time and effort by storing font, color and option information in a separate file in which you label every combination you desire with a single code number 42. You can make as many combinations of fonts and colors and options as you like and then store them each with their own code in a single file. You can use the same Styles file for all your experiments, or you can copy and modify as many different Styles files as you like-one for every experiment if you want. If you place a custom Styles file in the same folder as an input file 13, then that is the one DirectRT will use. If not, then DirectRT will simply use the default Styles file located in the main program folder.

### Every Trial Has a Style

In every input file, you'll notice that there is a column called "Style" 18. Every trial has its own Style value that is set in this column. Before the session begins, DirectRT opens the Styles file and reads every style in it. It organizes them by the code numbers 42 you give to them. Then as DirectRT prepares each trial it reads what style you want applied to it. DirectRT says "Style 12? No problem!" and proceeds to set the colors, the font, the alignment of stimuli and other settings according to style 12 in the Styles file.

You'll also see that you're not limited to a single style on any given trial. You can switch styles at any time by placing a style code in later columns of the input file 19. You can also place multiple style codes within a single text file 22 in order to present some nicely formatted text. See Formatting Text Files 64 sample for how to do this.

### Style Files

Every set of styles is located in a .DRT style file. Edit style files by double clicking on them, or open the style editor from the DirectRT main program window (select Edit->Style File)

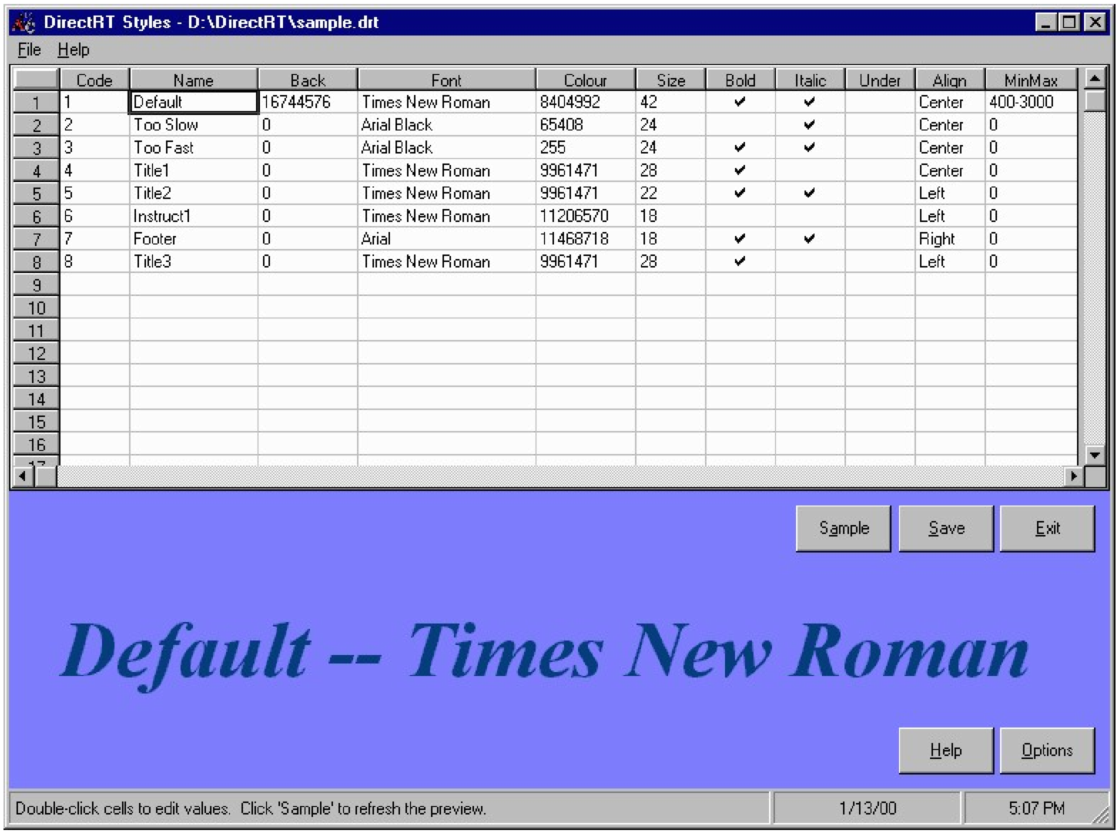
This section will explain the purpose of the different style options and explain how to use the DirectRT Style Editor 40.

### See Also

Style 18 - Setting Styles in Input Files

## 4.2 Main Style Window

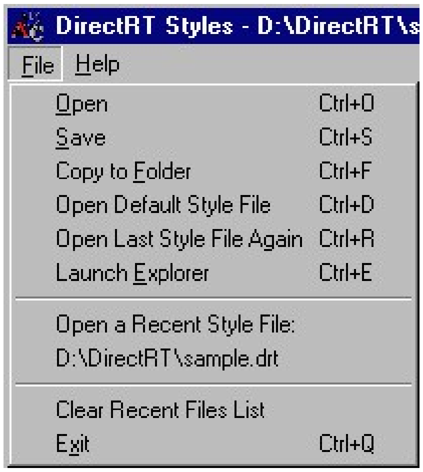
### Click anywhere for help on that topic


DirectRT Styles - D:\DirectRT\sample.drt
File
Help
Sample
Save
Exit
Default -- Times New Roman
Help
Options
1/13/00
5:07 PM

|  | Code | Name | Back | Font | Colour | Size | Bold | Italic | Under | Align | MinMax |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | Default | 16744576 | Times New Roman | 8404992 | 42 | ✓ | ✓ |  | Center | 400-3000 |
| 2 | 2 | Too Slow | 0 | Arial Black | 65408 | 24 |  | ✓ |  | Center | 0 |
| 3 | 3 | Too Fast | 0 | Arial Black | 255 | 24 | ✓ | ✓ |  | Center | 0 |
| 4 | 4 | Title1 | 0 | Times New Roman | 9961471 | 28 | ✓ |  |  | Center | 0 |
| 5 | 5 | Title2 | 0 | Times New Roman | 9961471 | 22 | ✓ | ✓ |  | Left | 0 |
| 6 | 6 | Instruct1 | 0 | Times New Roman | 11206570 | 18 |  |  |  | Left | 0 |
| 7 | 7 | Footer | 0 | Arial | 11468718 | 18 | ✓ | ✓ |  | Right | 0 |
| 8 | 8 | Title3 | 0 | Times New Roman | 9961471 | 28 | ✓ |  |  | Left | 0 |
| 9 |  |  |  |  |  |  |  |  |  |  |  |
| 10 |  |  |  |  |  |  |  |  |  |  |  |
| 11 |  |  |  |  |  |  |  |  |  |  |  |
| 12 |  |  |  |  |  |  |  |  |  |  |  |
| 13 |  |  |  |  |  |  |  |  |  |  |  |
| 14 |  |  |  |  |  |  |  |  |  |  |  |
| 15 |  |  |  |  |  |  |  |  |  |  |  |
| 16 |  |  |  |  |  |  |  |  |  |  |  |

Double-click cells to edit values. Click 'Sample' to refresh the preview.

## 4.3 Style Menu Commands



You can have different Styles files for different experiments. By default, DirectRT uses the style set located in the default Styles file "styles.drt." This file is located in the main program folder (e.g., c:\directRT\styles.drt). You can copy, modify and rename a Styles file and locate it in the same folder as your input file 13. DirectRT will first look for a local style file (i.e., one in the same folder as the input file). If it doesn't find one, it will use the default style.drt file in the main program folder.

**Open** - Select and open a Styles file

**Save** - Save the current settings of the open Styles file

**Copy to Folder** - Copies the current Styles file to another location. Note that DirectRT needs to save the current file before it does this. The original will be closed and the active file will become the copy in the new location.

**Open Default Style File** - Open the default Styles file (styles.drt) located in the main program folder. This is the Styles file that is assumed if no file is located in the same folder as the input file.

**Open Last Style File Again** - Open and edit the most recently opened Styles file.

**Launch Explorer** - Launches the Windows Explorer for file exploration and handling.

**Open a Recent Style File** - Choose from a list of most recently edited Styles files.

**Clear Recent Files List** - Clears the list of recent files. Clears the list only and doesn't have any impact on the files themselves.

## 4.4 Code - Assigning a Reference Number

### QuickInfo

**The style code is a number that identifies a particular style (e.g., font, colours, rt parameters) for trials in the input file. The numeric code is used as a reference in the input file such that when DirectRT encounters a new style code it changes the program setting accordingly.**

### Value

Any integer

### See Also

Referring to Codes in Input Files 18

Embedding Style Codes within Text Files 22

## 4.5 Name

### QuickInfo

**A text label you can use to give a meaningful descriptor to each code.**

### Value

Any.

Note: Be sure to refer to the style by its code number in the input file 18 and not whatever is in the Name column of the Sytles file.

### See also

About Styles and the Style Editor 39

## 4.6 Back - Background Colour

### QuickInfo

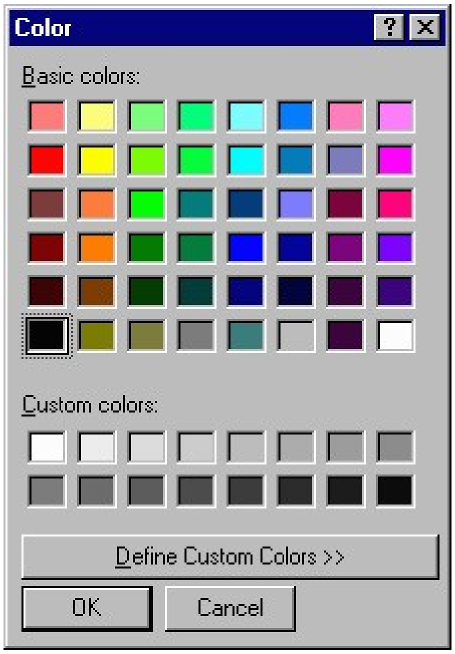
**The Back column in the Style Editor refers to the screen color upon which text and images are drawn. Double-click to select color from the Windows color dialog.**

### Values

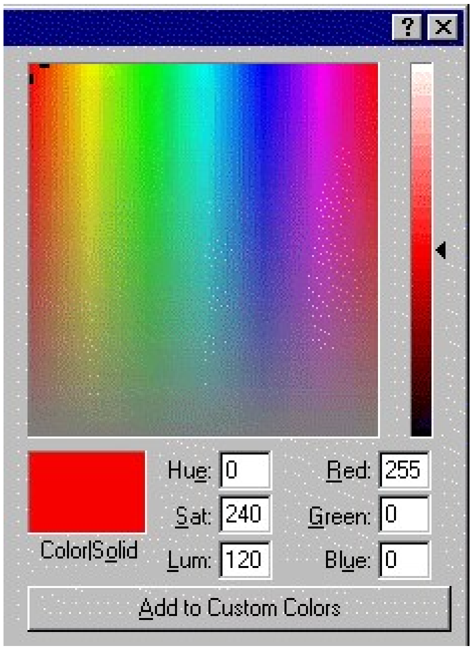
Any integer value in the range of 0 (Black) to 16777215 (White)

### Hints

In the Style Editor, when you double-click on the "Back" field, you will pull up the windows color dialog.



You can select one of the predefined colors and then click the "OK" button. DirectRT will enter the appropriate color code in the "Back" color column for you. If you need or desire more selection you can choose from the full range of colors available by selecting "Define Custom Color." This will pull up the custom color dialog window:



Hue: 0
Sat: 240
Lum: 120
Red: 255
Green: 0
Blue: 0

In this window you can click anywhere on the color spectrum to choose a color. If you first click on one of the standard colors (above) this will give you a starting point from which you can adjust. Either way, click "OK" when you're done to enter the color code. If you think you'll use the color again you can click, "Add to Custom Colors" so that it will be available for you as a standard "custom" color in the future.

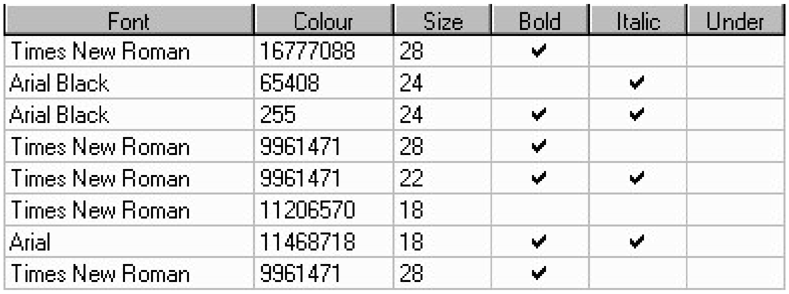
Note that if you like a color but it's too dark or too light it's easy to adjust this using the slider on the right hand side of the custom color dialog.

## 4.7 Font Settings

### QuickInfo

**Series of font variables for a given style**

### Details



| Font | Colour | Size | Bold | Italic | Under |
|---|---|---|---|---|---|
| Times New Roman | 16777088 | 28 | ✓ | | |
| Arial Black | 65408 | 24 | | ✓ | |
| Arial Black | 255 | 24 | ✓ | ✓ | |
| Times New Roman | 9961471 | 28 | ✓ | | |
| Times New Roman | 9961471 | 22 | ✓ | ✓ | |
| Times New Roman | 11206570 | 18 | | | |
| Arial | 11468718 | 18 | ✓ | ✓ | |
| Times New Roman | 9961471 | 28 | ✓ | | |

**Font** - Double-click to select from fonts available on the current system. Be sure to choose fonts that will also be available on any other machines you'll be using.

**Colour** - Double-click to select colour with which text will be drawn. Any integer value in the range of 0 (Black) to 16777215 (White). See Back - Background Colour 42 for more details on selecting colors.

**Size** - Size of the font in points. Values may range between 1 (extremely tiny) and 72 (extremely huge). The font with which this paragraph is displayed is 11 points.

**Bold** - Check to indicate the text should be bold.

**Italic** - Check to indicate the text should be italicized.

**Under** - Check to indicate the text should be underlined.

Note you can check any combination of the Bold, Italic, and Under options.

## 4.8 Align - Stimulus and Text Alignment

### QuickInfo

**Defines how stimuli appear relative to the location point defined in the Loc column 28 of the input file.**

### Values

Left, Center, Right

### Details

In the Loc column of the input file, you define a single point on the screen using horizontal and vertical coordinates.

The Align setting of the current style determines how stimuli (e.g., text and images) appear relative to this point on the screen.

**Left** - If Align is set to left, then the top left corner of the stimulus is placed at the point. Left alignment is especially useful when instructions are being presented via a text file 22 stimulus.

**Right** - If Align is set to right, then the top right corner of the stimulus is placed at the point. This is useful for special cases such as Hebrew text and footer text.

**Center** - If Align is set to center, then the center of the stimulus will be placed at the point. This is especially useful when displaying images 20 and text strings 21 of different sizes and you want them all centered on the same point.

### See Also

Loc - Stimulus Location 28 for more details and an example

## 4.9 MinMax - Setting RT Limits

### QuickInfo

**Defines the range of acceptable response times. RTs under the minimum or over the maximum cause a message screen to appear**

### Values

0 for none OR two integers separated by a dash (e.g.) 200-1500.

### Details

In some case you may want to notify participants that they are responding too quickly or too slowly. If so, you can associate a MinMax value with the style you are using for that trial. If the RT is under the minimum or over the maximum the participant will be presented with screens that you define in Options 47.

If you do not want the feedback to occur as a function of response time, then you would normally use a MinMax value of 0 (e.g., in the case of instructions)

However, if you have some other reason to use a MinMax value other than for feedback (see below) and you don't want feedback displayed, then you can simply tell DirectRT to display the feedback for 0ms. To do this click Options 47 while in the Style file and set the delay value for feedback to 0.

### Advanced Options

#### *Automatic Continuation*

An exclamation mark (!) following the value in the MinMax field will cause DirectRT to automatically proceed when the maximum time allowed for the response is reached (e.g., 200-1500!). Otherwise, DirectRT will wait for the response defined in the Time column 31 cell for that stimulus before delivering the message assigned for exceeding the maximum response time.

Note that automatic continuation will cause DirectRT to continue with the remainder of the trial if there is anything left to present. In a case where you would prefer that the remainder of the trial be skipped if the time is exceeded, then use !! rather than the single !

An alternative to using the ! symbol is to define -1 as a valid response code in the Time column cell of that trial. That way, only trials on which -1 is given as a valid response option will continue automatically after the maximum time has been reached. Like other rt related codes, if -1 is listed first, then it will be considered the correct response. This option can also be combined with the ! method if you want to define no response as correct but have automatic continuation regardless of the response. You can think of -1 as an actual "no response" button which is pressed at the maximum response time.

### *Fixed Response Window/Stimulus Duration with an RT*

By default, DirectRT will continue to the next event when an valid keypress response occurs. You can optionally have DirectRT wait until a fixed amount of time has passed instead. Let's say you want to present a stimulus and define a keypress response, but you want that stimulus on screen for 2000ms—no matter how fast the response. To do this specify a max value of 2000ms in the MinMax field for the style code in the Styles file 42 that matches the style code of the trial in the input file 18. Then, when you request the RT in the Time column 31 cell for that trial your input file, simply add the keyword "full" at the end like this:

```
rt:53,44,full
```

This method can be combined with the automatic continuation method above. If you want a fixed response window but you want the stimulus to disappear after the response, then add the term "clear-1" as in the following:

```
rt:53,44,full,clear-1
```

This is a special case of a more general command used to clear a stimulus while waiting for an RT to occur. See Clear screen while waiting for an RT 78 for more detail on this command.

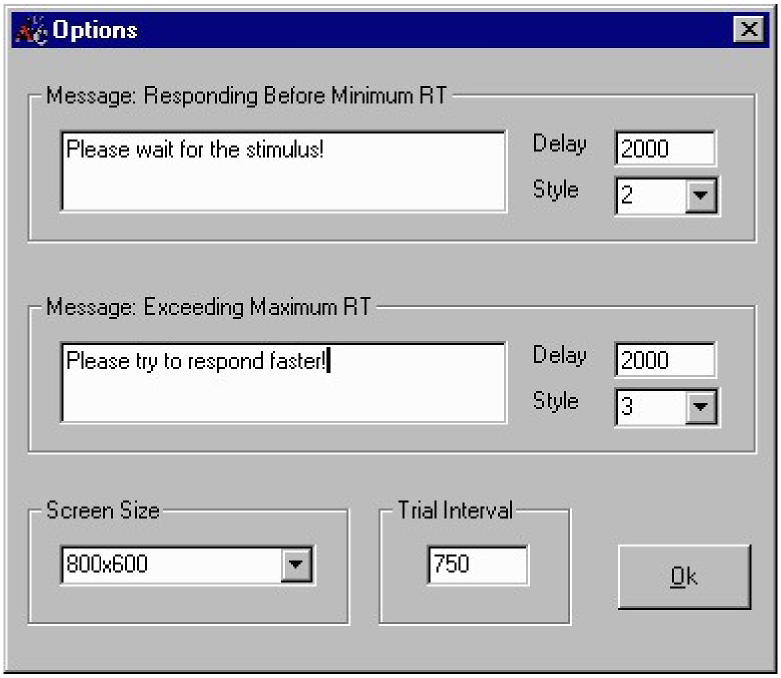
## See Also

Options Window 47 for details on defining the MinMax feedback events.

# 4.10 Options

## 4.10.1 Options Window

**Select an area for more detailed information:**



Message: Responding Before Minimum RT

Please wait for the stimulus!

Delay 2000

Style 2

Message: Exceeding Maximum RT

Please try to respond faster!

Delay 2000

Style 3

Screen Size 800x600

Trial Interval 750

### See also

About Styles and the Style Editor 39

## 4.10.2 Messages

### QuickInfo

Defines the feedback events that will occur if the participant responds before the minimum response time or after the maximum response time for a given trial.

### Details

**Message: Responding Before Minimum RT** - This is the message that will be displayed if the participant's response is less than the minimum allowable response time set in the MinMax field of the style code for that trial.

**Message: Exceeding Maximum RT** - This is the message that will be displayed if the participant's response is greater than the maximum allowable response time set in the MinMax field of the style code for that trial.

**Delay** - This is the number of milliseconds for which the message screen will be displayed before the trials resume. Separate delays can be defined for breaking the minimum and maximum response times.

**Style** - This is the style setting for the feedback screen. Separate styles can be used for breaking the minimum and maximum response times.

Note that these feedback events will not occur if you set the MinMax value of the trial's style to 0.

### See Also

MinMax-Setting RT Limits 45

About Styles and the Style Editor 39

## 4.10.3 Screen Size

### QuickInfo

**Determines the screen resolution in which the DirectRT session will be run. The essential trade off is that text and graphics look better under higher resolutions (e.g., 1024x768), but run faster allowing very short display times under lower resolution (e.g., 640x480).**

### Values

640x480, 800x600, 1024x768, up to 1600x1200 and above

### Details

DirectRT will automatically switch the display to the resolution set here and then set it back to the default monitor settings when the session is complete. Note that text and images will appear smaller under higher resolutions than they do in lower resolutions. This is because it takes less screen space to display the same number of pixels. Make sure you consider what resolution you will run your session in when sizing your images and text. For example, a 640x480 image like ones in the samples will fill the whole screen in 640x480 mode, but only about half the screen in 1024x768 mode.

Note that the display size you choose here may have an impact on your refresh rate 6. Many computers will store a unique refresh rate for each resolution they support. This means setting the refresh rate for one resolution doesn't necessarily set it for all available refresh rates. The trick is to manually set your display to the desired resolution through the display settings in the Windows Control Panel, and manually set the refresh rate while you're there by clicking on the display's advanced settings. Whatever refresh rate you set here is what DirectRT will be using when it enters this specific screen resolution.

### Important Note

DirectRT asks your system about what it can handle and will allow you to run sessions using any resolution your monitor will allow. Taking advantage of this features means you will want to ensure other computers on which you want to run the sessions also are able to use the chosen resolution. The values 640x480, 800x600 and 1024x768 are usually safe on most systems.

### See also

About Styles and the Style Editor 39

### 4.10.4 Trial Interval

**QuickInfo**

**Sets the inter-trial interval in milliseconds.**

**Value**

Any integer, typically in the range of 350-2000ms

**Details**

As soon as DirectRT finishes a trial it determines the background color of the next trial, and immediately flips to a screen of that color and begins the Trial Interval. This is the amount of time that must pass before your first stimulus of that next trial is displayed. During this time, DirectRT begins building all of the screens that will be required for the trial. This requires TIME--hopefully, less time than you have requested as the Trial Interval! If so, DirectRT will return with all the screens prepared, and wait for the Trial Interval to expire. 1000ms is usually safe.

**More Detail if You're Interested**

The time DirectRT requires to prepare the trials will depend on the number of screens needed for a trial, the media being used, and the power of the computer. Because DirectRT does all of this construction in the background WHILE the trial interval is occurring, the construction process has NO effect on timing so long as you set a Trial Interval that is greater than the time it takes to load everything. Usually an interval of 1000ms is sufficient for most computers, although some computers my need as little as 10-100ms even for complex trials.

You can experiment with this. In the Log file that DirectRT creates, it records the number of milliseconds it takes to load each of your trials. You'll see in every case where the load times were less than your Trial Interval, the Trial Interval was maintained. If there is ever a case where it takes LONGER than the interval to load the trials, then the interval will be extended for as long as it takes to finish preparing the trials.

If you requested a sequence of 10 full screen full color images to flash during a single trial, then a trial interval of 200ms would not likely give the system enough time to prepare. In such a case, the trial would begin as soon as possible and the extra time required would be recorded in the log file so you could adjust your Trial Interval accordingly.

**See also**

About Styles and the Style Editor 39

# 5 Running an Input File

## 5.1 Running from the Main Program

**QuickInfo**

The easiest way to run an input file is through the main program window of DirectRT (what you see when you run DirectRT.exe). From the file menu 9, select "Select and run input file," or hit Ctrl-S.

## Details

### Selecting an Input File

From the Files menu of the main program window, you have three ways to select an input file to execute:

#### *Select and Run Input File*

If you haven't executed the input file before, this choice allows you to search through the folders on your machine to find the desired input file. Locate the input file and then either double click on it, or select it and click "open.'

#### *Run Last Input File Again*

This choice will execute the input file most recently run on the machine. The key sequence "Ctrl-R" will perform the same function. This command is handy when multiple participants are being run back-to-back using the same input file, or when you're developing and testing an input file.

#### *Run a Recent Input File*

DirectRT keeps track of the ten most recently run input files and displays them in the Files menu. Clicking on any one of them will re-run the selected input file (assuming it's where you left it).

### Subject and Condition

After selecting your input file, you will be prompted to enter a subject and condition ID (these are just for your own tracking purposes and have no impact on the session). Enter any numeric value for Subject and any alpha-numeric value for Condition and then press OK to start the session. Note that your condition value will usually be "1" unless you are tracking some between subject assignment (e.g., an independent mood manipulation prior to the DirectRT session).

### Running a Range of Trials

To run a select range of trials from the input file, type the range in the Range field. Do this by indicating the first and last rows of the input file you want to run, separated by a dash (e.g., entering 5-15 would cause DirectRT to run the trials located in the 5th though 15th rows of the input file). To run all the trials you can simply enter the word all.

To stop a session early, press "Esc" and the session will end and the data up that point will be saved.

### See also

Running from Command Prompt 51

Running from MediaLab 51

## 5.2 Running from a Command Prompt

### QuickInfo

**You can bypass the DirectRT window and subject/condition prompt by using the command line option.**

### Details

If you are a programmer and want to launch DirectRT from another program or if you want to run DirectRT from a batch file then this is the syntax:

```
ExecuteDRT.exe /subject,condition,input file,range
```

### Where

- Subject is an integer
- Condition is any alpha-numeric string
- Input file is the full path and file name of the input file to run
- Range is the range of trials to run ('all" for all trials)

### Examples

```
ExecuteDRT.exe /1,1,c:\directrt\samples\sample1.csv,all
```

```
ExecuteDRT.exe /23,2,c:\input files\input1.csv,all
```

```
ExecuteDRT.exe /345,c4,c:\input files\input1.csv,5-37
```

### See also

Running from Main Program 49

Running from MediaLab 51

## 5.3 Running From MediaLab

### QuickInfo

**With MediaLab, you can easily embed a DirectRT session within your MediaLab experiment. Subject and Condition info will be consistent.**

### Details

You can run your input file from MediaLab. Simply select ***DirectRT Session*** as a questionnaire item and enter the input file in the ***File*** field. MediaLab will pass the current subject and condition Ids to DirectRT, launch the session, and then resume where it left off when the session has completed.

Note that DirectRT will still output its own data files 54 that are separate from the MediaLab data files. You will be able to easily match them up though since DirectRT will use the subject and condition info from the current MediaLab Session.

Important: It is strongly advised that you don't run two DirectRT sessions from MediaLab back-to-back. DirectRT can fail to load if a previous instance of it has not yet had a chance to fully shut down. An easy fix for this is to insert a simple MediaLab instruction item between the DirectRT sessions (e.g., reading "Press the spacebar to continue").

### Advanced Hint

If you only want to run a range of trials then use the c (command line argument) parameter followed by the range (e.g., c12-44), otherwise you can leave the parameters field as "none".

### See also

Running from Main Program 49

Running from Command Prompt 51

# 6 Output Files

## 6.1 Short Data Files

### QuickInfo

**Short Data Files contain the essential data for many study designs.**

### Details

***Subj***

The subject ID entered manually at the start of the session or passed through another program via a command line prompt.

***Cond***

The condition ID entered manually at the start of the session or passed through another program via a command line prompt.

***Block***

The Block ID label 14 assigned to the trial in the input file

***Trial***

The Trial ID label 15 assigned to the trial in the input file

***Order***

The ordinal position of the trial in the actual session. This vary as a function of how the trials were randomized.

***! Optional***

If you have used Optional Fields[15] in your input file to identify characteristics of trials they will be written after the Order column.

***Resp***

This is the keycode[93] associated with the key pressed by the subject. If multiple key presses are required on a single trial (e.g., multiple instruction screens each requiring the subject hit the spacebar), this will be the code associated with the last key required.

***Name***

The name associated with the key pressed by the subject (e.g., "A", "3", "SPACE").

***Stim***

The final stimulus presented before the reaction time was captured.

***RT***

The reaction time in milliseconds.

***Correct***

A true or false value according to whether or not the subject's key press corresponded to the first valid key listed for that trial in the input file.

### See also

Additional Fields Written to the Log Data File[53]

## 6.2 Log Files - More Data!

### QuickInfo

**Log Data Files contain all of the columns contained in the Short Data File[52] as well as these additional columns:**

### Details

***Date***

Date the session was run

***Time***

Time the session was begun

***File***

Name of the input file

***Started@***

Number of milliseconds expired between the start of the first trial and the beginning of the current trial. Keep in mind that the trials are written to the data file in their origional order-not the order in which they were presented. If you want to follow the time sequence, you can sort the data file by the Order column 52. This value is the actual difference in the two times and is independent of all other time measures.

***LoadTime***

The number of milliseconds it took DirectRT to prepare all of the screens for the current trial. This is done during the interval for the trial 49 and does not add to the time it takes for the trial to execute. This is important to monitor though. You want to make sure that this value never exceeds the actual trial interval value that you've specified. This is usually not a problem, but you can verify this by examining the TotalInt value (next column).

***TotalInt***

This is the amount of time from the end of last stimulus screen of the previous trial to the beginning of the first stimulus screen of the current trial. This value should approximate the value in the Style file, Options->Trial Interval 49. Very slight variations in this value between trials is normal (about 10ms). Timing then becomes precise at the start of the first stimulus. If you find a TotalInt value that significantly exceeds the trial interval you specified, this can mean you have not set a sufficiently long interval such that DirectRT can prepare all of the stimulus screens before your interval is up. In such cases, try extending your trial interval 49.

***Stim n***

The name of each stimulus screen subsequent to the trial interval

***Time n***

The actual display time for each stimulus screen. You might notice that the display time for the final stimulus is usually a little bit longer than the RT value (e.g., 1-15ms longer). This is because the time at which the subject responds is not the exact time at which the stimulus leaves the screen. Depending on how early into the screen refresh cycle the response occurs, the stimulus may be displayed for an additional number of milliseconds.

#### Doing the math if you're interested

If you want to account for where all the time has gone, then sort your data by the Order column (or the Started@ column) so that the trials are in their temporal order. If you take the trial's start time (Started@) and add the trial interval (TotalInt) and each of the Time n values, then this should add up to the Started@ value of the subsequent trial.

Do not include the LoadTime value because this is going DURING the trial interval.

Make sure you don't have any missing trial data if you're going to do this (e.g., this won't work if you have omitted trial data from the data file by specifying a Block ID of 0-at least for trials surrounding this missing trial(s)).

### 6.2.1 Overview of Data Output

#### See Also

Short Data Files 52

Log Data Files 53

### Overview

When DirectRT finishes running an input file, it writes the data file to a "data" subdirectory located in the same folder as the input file. If the data subdirectory does not exist, DirectRT creates it. Since DirectRT will anticipate you running multiple subjects with the same input file it will create a subfolder with the name of your input file. In this folder will be the data for each subject you run using that input file.

For example, if you have an input file called:

```
c:\input files\input1.csv
```

Then DirectRT will create a folder:

```
c:\input files\data\input1
```

And then it will create a data file for each subject. For example, data from Subject 34 and Subject 35 would be in the following files, respectively:

```
c:\input files\data\input1\34.csv
```

```
c:\input files\data\input1\35.csv
```

These data files are short form data files 52 that are useful for most purposes. DirectRT also creates log data files 53 that contain much more information if you need it (e.g., exactly how long each stimulus was displayed). These files are placed in a log subfolder. For example,

```
c:\input files\data\input1\log\log_34.csv
```

```
c:\input files\data\input 1\log\log_35.csv
```

### An Alternative Method

If you have many different versions of an input file and don't want the data from each one put in a separate folder then you can do the following: Name your input files with common name (e.g., input) and then use an underscore and an ID, e.g., input_1.csv, input_2.csv, etc.). DirectRT will create folders in the data directory using the common name and will place any data from input files sharing that common name in the same folder (e.g., c:\input files\data\input). You will be able to identify exactly which input file the subject received because it's written to the log data file.

### Analyzing DirectRT Data

DirectRT data files are vertical, that is, each subject has many rows of data rather than having all of their responses placed on a single line (e.g., like MediaLab data files). This creates a certain challenge for analysis. While DirectRT is not an analysis program there are a few things to know which might help you if you're new to this type of data file.

A common approach is to use the DirectRT filemerge program (see below) to create a large single data file from the many individual files (be sure to use the option to skip the first line on each file which is the variable name header). Then rename this large file with a .csv extension so that you can import it into SPSS. Once the .csv file is in SPSS, you can use the SPSS COMPUTE and TRANSFORM functions to separate the data into appropriate columns and create the variables you want. This is often easier if you have used comment columns 15 to indicate your within subject conditions. Then the trick is to apply SPSS's AMALGAMATE function which can do the rest for you. Separating according to subject, you can request means and standard deviations to be calculated and imported into a new file, and voila: a dataset with each subject as a row and the means and standard deviations of relevant variables as columns. Be sure to make a copy of the SPSS syntax so that you can use the technique over and over again as needed.

### Merging Data Files

If you're looking for a convenient method for merging the data files that does not require SPSS, DirectRT offers a utility called FileMerge (..\DirectRT\FileMerge\FileMerge.exe) to do this rather painlessly. Essentially all you have to do is drag the files you want to merge into the FileMerge window and select "Merge Files" from the File menu. If you like, you can also save the list of files to merge them again later. A quick tutorial on FileMerge is available by clicking on the FileMerge Help menu. You can also start FileMerge by selecting a "Merge Data Files" from the DirectRT Tools menu.

### See also:

Block ID 14 for rules regarding which trial data are written to the file

# 7 DirectRT Tutorial

*The following text is taken from the interactive tutorial located in the help folder after installation. You may prefer to print these pages rather than having them on-screen during the tutorial.*

A good way to get the feeling of how DirectRT works is to run through the following series of samples sessions and then look at how they were put together. You can access these same samples by selecting "DirectRT Samples" from the Help menu of the main DirectRT program window. You can also access the samples directly if you like-they're located in the "samples" folder of the DirectRT directory. When creating your first input files you may wish to copy an appropriate sample folder and simply modify it to meet your needs.

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### More Samples

The samples above are those intended to give you a good basic understanding of how DirectRT works. There are other useful features of DirectRT though that you can explore later in the following samples (all located in the DirectRT samples folder). To access additional samples or to post your own, please visit http://support.empirisoft.com and click on *DirectRT: Shared Experiments*.

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# 7.1 Bare Bones

## 7.1.1 Text

**Location:**

…\DirectRT\samples\1 bare bones\text.csv

**Description**

In this first sample, you'll see the bare minimum it takes to run a DirectRT session. There are no external stimuli and no stimulus lists. Everything is located in the input file. Using Excel or a similar spreadsheet program, open the file indicated above to see what the input looks like.

The block[14] and trial[15] columns are for your own reference. They'll be written to your data file[54]. The trial column also serves a useful purpose when you want to use skips[35] and jumps[37]. The block column can also indicate you don't want data written to the data file if you use a 0.

The bgr[17] and wgr[17] columns are for randomization. Currently they're all set to 0 which means that no randomization of trials will occur.

The style[18] column indicates that all trials are to be presented in style 1. More detail on styles will follow shortly in another sample.

Then come the three critical columns: Stim, Loc and Time. In this sample there is only one set for each trial.

In the Stim[19] column, the ~ indicates that the stimulus is the actual text in the cell[21]. The Loc[28] column tells DirectRT where to place the stimulus and whether to clear the screen or append the stimulus to the previous screen. 0,0,1 is a shorthand way of telling DirectRT to center the stimulus and to present it on a fresh screen.

Finally, the Time[30] column tells DirectRT what to do after the screen is displayed. In this case, 'RT:any' indicates that it should wait for any key response.

Try running the input file by choosing Select and Run Input File from the file menu in DirectRT. When you see each word appear, press any key and your response time will be recorded.

Now, let's look at the data you just produced--these files will be located in a data subfolder along with the input file--you can view them in Excel. Note that there are two data files that DirectRT produces for each session: a simple one[52] useful for most needs, and a more detailed one called a log file[53] that records everything including actual display times for your various stimuli. Most of the columns in the data files should self-explanatory. The two most important columns are name and RT. This tells you which key you pressed and your reaction time. See Output Files[54] for the details regarding any specific column.

That's it! That's a bare bones DirectRT session. As an exercise, try changing some of the stimulus values in the input file (e.g., change dog to puppy) save the file and re-run it. Be sure to save the file in the .csv format even if your spreadsheet application warns you that you'll lose formatting. The .csv format is critical because that's what makes the input files independent of any particular spreadsheet application.

Now we'll start adding some more DirectRT features…

## 7.1.2 Images

### Location

…\DirectRT\samples\1 bare bones\images.csv

### Description

Notice that this sample is identical to the previous text sample, with the exception of the Stim 19 column. Notice that there is no ~ before each stimulus. If there is no special character preceding the stimulus, this tells DirectRT that you want to display an image 20. You do not need to add the .bmp to the end, because DirectRT assumes it (although you can put it there if you like).

By default, DirectRT assumes that all stimuli are located in a Stim folder located in the same folder as the input file. So if the image is in the Stim folder, then all you have to do is enter the name of the image. That's what's happening here.

If it's located somewhere else, then you could specify the exact location (e.g., c:\images \pic01). If the image is located in a folder within the Stim folder, then you just need to add the name of that subfolder (e.g., faces\pic01).

Try running this session and see what happens. You see that is works the same as the text sample, except that images appear instead of text.

As an exercise try dropping a .bmp image of your own in the DirectRT\samples\1 bare bones\stim folder, and change one of the images in the Stim column of the input file to the name of your image file. Save the file and re-run the session and see what happens. Note that this session runs in 800x600 mode so an image of those dimensions or less will work best. We'll look at changing display modes a little later.

As an additional exercise, try adding a ~ in front of one of the image names and see what happens. Can you guess?

Hint: for exploring folders and copying files, you can just click Launch Explorer from the File menu of any DirectRT application.

## 7.1.3 Text Files

### Location

…\DirectRT\samples\1 bare bones\textfiles.csv

### Description

Take a look at the input file for this sample. In this example, notice that the input file is identical to the previous sample except that we've added two trials at the beginning and one trial at the end. In these new trials, look at the Stim 19 column. There is a # character in front of each stimulus. This indicates that stimulus is an entire text file 22. As with images, you don't need to put the .txt at the end, because DirectRT assumes it.

Try running the session and see what it looks like. This is a really handy way to present instruction screens or other large quantities of information with a minimal amount of effort.

As an exercise, try opening the file ..\DirectRT\samples\1 bare bones\stim\instruct1.txt and modify it. Save it and then re-run the session.

Later we'll see how to easily change the text alignment and text formatting so you have more control over how the text file appears.

## 7.1.4 StimLists

### Location

…\DirectRT\samples\1 bare bones\stimlist seq.csv

…\DirectRT\samples\1 bare bones\stimlist truerand.csv

…\DirectRT\samples\1 bare bones\stimlist rand.csv

### Description

Rather than specifying a specific stimulus on every trial (as in the previous three samples), you can opt to request that the stimulus be chosen from a stimulus list or StimList 22. StimLists are text (.txt) files that you create with any text editor that simply list stimuli. This can be especially handy if you want to randomize the stimuli that fill particular positions in your input file. There are three types of StimLists.

In the first example, notice that the input file named "stimlist seq.csv" is identical to the last one except that instead of identifying specific stimuli in the Stim column, we have replaced the image names with &pics. In the stim folder is a file called pics.txt. This file simply lists all of our images just as we would have entered them in the stim column. The & symbol tells DirectRT that you want to draw stimuli from this list sequentially 23-i.e., in the order they appear in the text file. Try running the session and see how it looks. We've labeled each image so you can see that they are appearing sequentially as specified in the list.

Now, open the input file named "stimlist trurand.csv." Notice that it's the same as the last except that instead of the & symbol, the StimLists are preceded by the % character. This tells DirectRT to randomly select a stimulus from the list 23. Try running the session. Notice that since this is True Random selection, some of the images may appear twice or more. If you take a look at the data file created by this input file, you'll see that the Stim1 column tells you which image was selected and presented.

Finally, take a look at the input file named "stimlist rand.csv." This time, we use the $ symbol. This again tells DirectRT we're using StimList, but that we want the stimuli selected randomly without replacement 23. DirectRT will make sure all of the stimuli are used before it re-randomizes the file and starts over.

As an exercise, try adding a stimulus or two to the ..\DirectRT\samples\1 bare bones\stim \pics.txt StimList in any text editor. Try entering an image that's located somewhere else on your hard drive, such as c:\images\mypic. Or add a text item such as ~I love pizza!, or a text file such as #instruct1. Place the additional stimuli anywhere in the list, save it, and re-run any of these session and see what happens.

## 7.1.5 Setting Valid Keys

### Location

…\DirectRT\samples\1 bare bones\validkeys.csv

### Description

In the previous samples, you have been able to hit any key and the session would continue. Often you will want to limit subjects to particular key presses.

Open the input file for this sample and see what's different from the last one. Notice that instead of RT:any, we now see RT:num,numpad indicated for the image trials. Try running this session and see what happens. When you see an image try to press any key other a number. Num allows the regular keyboard numbers and numpad allows those on the keyboard number pad (if it has one).

You set valid keys by separating them with commas after the RT:

All of the valid key codes can be accessed by clicking "Keycodes[93]" from the main Help window, or by clicking on KeyCodes in the help menu of the main DirectRT program. Try this. For example, see that the code for the Z key is 44 and the code for the / key is 53. If you want to limit responses to either of those two keys, you would enter RT:44,53. Try changing the one of the values to RT:44,53 (or any other codes) and see what happens. You can list as many codes as you want.

Notice that for the instruction screens we have left the value at RT:any. This is because for instructions we don't really require any specific key be pressed. You could optionally limit it to the spacebar (57) or the enter key (28) or other key(s).

Hint: Whichever code you list first defines the "correct" key for the trial. If the subject hits the "correct" key, then a value of TRUE will be written to the Correct column of the data file[52]. Other valid keys listed after the first code will produce a value of FALSE. This is useful of course only when you have one correct value but wish to define more than one valid keypress for a stimulus and can be ignored otherwise.

## 7.1.6 Changing Styles

### Location

…\DirectRT\samples\1 bare bones\changestyle.csv

### Description

This example shows how you can apply different styles[39] to different trials. First, open the barebones.drt style file located in the same folder as the input file above. Click anywhere on style 1 and see that the preview window shows what you've been seeing so far. Click on style 2 and style 3 and see how they differ.

Now open the input file above. See that we've changed the Style[18] values for the first two instruction screens and for the debriefing trial.

Run the session and see what happens.

Notice that the styles of the instruction and debriefing trials have changed to reflect the styles assigned to them.

As an exercise, try modifying any of the three styles. You can change the font[44], the foreground and background colors[42] and the alignment[44] of the text. Save the style file [41] and re-run the session. Or, create a new style and enter the style code for any one of the trials.

Congratulations! You have finished the Bare Bones portion of the Tutorial!

## 7.2 Basics

### 7.2.1 More Stim Per Trial

**Location**

…\DirectRT\samples\2 basics\morestim.csv

**Description**

Now that you've been through the fundamentals, we're ready to start adding some zest to our study. In this sample, you can see how you can use as many stimuli on a single trial as you need. For each stimulus, you simply add another set of Stim[19], Loc[28] and Time[30] cells to the trial row of your input file.

Check out the input file for this sample. Notice that it's very similar to the ones we were just using. The difference is that on trials 3-10, we've inserted two extra stimuli. Can you tell what these stimuli will look like?

First notice, that we inserted ~XXXXXXXXXX as the first stimulus for each of these trials. Since the ~ indicates that they actual text[21] in the cell should be presented, the string of X's will appear in order to focus the subject's attention on where the next stimulus is about to appear. The time column tells DirectRT to display this stimulus for 500ms.

Next, we see an adjective as the next stim in the sequence for each trial. The adjectives also are preceded with ~ indicating that the text in the cell is the stimulus. The time column for the adjectives on each trial indicates the adjectives will appear for 100ms.

Finally, we see the final stim on each of these trials is $pic, which you saw in previous samples. Again, the $ symbol indicated that pic is a text file (pic.txt) listing stimuli from which DirectRT will draw randomly without replacement[23]. In this case pic.txt again contains the names of image files. The time column for the pictures indicates the images will be displayed until a response key is hit, and that only the Z (code 44) or / key (code 53) will be considered valid.

Important: Note that you can have as many stimuli as you like on any given trial. The important thing to know is that, as always, you need to enter a * in the final cell of the row. This is a terminator, telling DirectRT you're done with that trial at that point.

### 7.2.2 Basics Of Style

**Location**

…\DirectRT\samples\2 basics\morestim.csv

**Description**

This next sample is actually the same as the last. However you'll see how to apply a few other aspects of the style file.

Take a look at the MinMax[45] value of the different styles. See how only Style 1 has a value for this? This tells DirectRT that you want to set a minimum and maximum RT value for any trial to which this style has been applied. Typically you wouldn't set a MinMax value for instruction screens.

Now click on the Options button in the lower right. There are a couple of important variables you can change here.

First you can see the messages[47] that appear for trials on which subjects respond too slow or too fast. Try changing these messages to something you'd like. You can also change the delay-that is, how long the message stays on the screen. You can also change the style that's applied to the message. Try setting each to one of the other style codes[42] in your Styles file.

You can also set the trial interval[49] here. This is the amount of time that passes between the last stimulus of the last trial and the first stimulus of the next trial. It's important that this be sufficiently long for DirectRT to load and prepare the next trial if you want your trial interval to be constant.

Finally, you'll see here that you can change the display size[48] that your session runs in. These samples were prepared to be run in 640x480 mode, but try selecting 800x600 or 1024x768 just to see what happens when you rerun the input file. Just make sure to switch it back for the remaining samples.

## 7.2.3 Locating Stim

### Location

...\DirectRT\samples\2 basics\locate.csv

### Description

This sample shows how any stimulus can be precisely located anywhere on the screen. This is input file is the same as the last with the exception of the Loc[28] columns. Remember the Loc column has three variables in it: x, y and clear each separated by a comma. X and y define a single point on the screen that determines where the stimulus is placed. You can enter in actual pixel values (e.g., 200, 150 etc.) but an easier way is to use percentages (e.g., .3, .7). For example if you want to define a point that is 30% across the screen and 70% down, you would just enter .3,.7 for the x,y values. Note you can always enter 0,0 and this will automatically center the stimulus. Entering 1,1 will place it at the left, top corner.

Run the session and watch how the stimuli are located as a function of the Loc values.

In this sample the x,y point determines where the center of the stimulus is placed. If you're interested, see LOC (locating stimuli) to read more about setting location parameters.

Finally, Clear defines whether to clear the previous screen before drawing the stimulus (Clear = 1), or whether to add to it (Clear = 0) We'll look at the clear values and what they can do in the next sample.

## 7.2.4 Compound Screens

### Location

...\DirectRT\samples\2 basics\compound.csv

### Description

This is a tricky but pretty powerful concept. Open the input file and see that it's the same as the last except that we have added a new stimulus to each trial. Just before each image appears, we've added an image called scale1. This is a graphic of a scale that we'd like to have appear on the same screen as the reaction time stimulus (i.e., the faces).

To do this, we insert scale1 as a stimulus and locate it where we want it. We've told

DirectRT here to place it at x = .5, y = .95, which is telling it to place the center of the image half way across and 95% of the way down the screen.

The trick? Notice the Time 30 column for the scale image. It's 0! This tells DirectRT to create the screen but not to display it! Why would want to do this?? Because if on the NEXT screen we tell DirectRT to NOT clear the last screen, then this previous screen will serve as a BACKGROUND for the next stimulus.

Sounds complicated but it really isn't. All this means is that by using 0's in the Clear value of the Loc 28 column you can have layers upon layers of stimuli appending to the same screen. If you set the Time value of any of these stimuli to 0, then they will appear at the same time the subsequent stimulus appears.

I hope this is making sense.

Finally, notice that the on the last two trials (before the debriefing) the clear value in the Loc column of $pic is set to 0 instead of 1. Notice how when you run the session, the adjective stays on the screen when the picture appears. As an exercise, try setting the Time value of one of these adjectives to 1000 instead of 0. See that this makes the adjective appear for 1000ms before the image appears, but still remains on screen because it is never cleared in any subsequent Loc column.

## 7.2.5 Formatting Text Files

### Location

...\DirectRT\samples\2 basics\formattext.csv

### Description

Congratulations for making it this far! The hard stuff is over and things will start moving a lot faster now. This input file is the same as the last except that it calls some different text files for the instructions and debriefing.

Check them out: instruct3 instruct4 debrief2.

This is to show how you can insert style codes from your Styles file 42 in the middle of text files 22. Try running the session. As an exercise, try changing the text or the styles and see how it looks. Or create a new style and then refer to in your text file.

## 7.2.6 Using Optional Fields

### Location

...\DirectRT\samples\2 basics\optionalfields.csv

### Description

The final lesson in the Basics is to show you about Optional Fields 15. Open the input file and check out the new column. There's a new column inserted called "!Prime" This is totally for you so that you can identify which trials are which when analyzing your data. You can add as many of these optional fields as you want. Just make sure they all go after the trial 15 column and that column header always starts with !

For example, in this input file, the "!Prime" optional field indicates which trials have a positive adjective as a prime and which have a negative adjective. Since Optional Field columns are written to the data file, this will make analyzing the data much easier.

As an exercise, try adding another Optional Field column beside the !Prime column and entering some values for each trial. Run the session and then open the data files to see that your new optional field was written.

Congratulations! You have finished the Basics!

# 7.3 Ordering Trials

## 7.3.1 RWG

### Location

…\DirectRT\samples\3 ordering trials\rwg.csv

### Description

The next three samples show some of the basic methods for the quick and easy randomization of trials.

The first method, RWG stands for Randomization Within Groups 17. Open the input file and look at the wgr column. Every item that shares the same RWG value with another belongs to the same RWG group. Items sharing the same RWG value will be randomized with each other no matter where they are in the list of trials. The only exception is if an item is assigned an RWG value of 0, then it will stay exactly where it is. Often, instruction trials will be given an RWG value of 0.

Try running the session and see what happens. Notice that the stimulus for each trial is the trial number itself so that you can observe the effects of the randomization.

As an exercise, try randomizing all the trials by assigning them each an RWG value of 1.

## 7.3.2 RBG

### Location

…\DirectRT\samples\3 ordering trials\rbg.csv

### Description

A second basic method of randomization, RBG, stands for Randomization Between Groups 17. As with RWG, every trial that is assigned the same RBG value belongs to the same RBG group. The difference is that instead of randomizing the trials within the group, all the items are treated as a set to stay together. DirectRT will then randomize the order in which the different RBG groups is presented.

Open the input file and take a look at the RBG values in the bgr column. Notice that there are three RBG groups (1, 2 and 3). Run the session and notice what happens to the ordering of the trials. You'll notice that the order of the trials within each group doesn't change-just the ordering of the groups themselves. Also notice that any trials with an RBG value of 0 never moves. DirectRT knows not to include any trial with a value of 0 in the bgr column.

Important: In order for trials to share the same RBG value, they all need to be together in one continuous set. Don't use the same RBG value for trials that are not contiguous in the input file.

## 7.3.3 RBG + RWG

### Location

…\DirectRT\samples\3 ordering trials\rbg rwg.csv

### Description

Can you guess what's next? That's right, we can combine RBG and RWG values to randomize the order in which sets of items occur (RBG), and also the order of the trials within those sets (RWG). Open up the input file and you can see that we have values for both RBG in the bgr column and RWG in the wgr column.

Run the session and see what happens. Can you predict?

Notice trials 11-14. They all belong to the same RBG block which means that set of trials may come 1st, 2nd, or 3rd out of the three RBG groups. However, unlike set 1 and 2, they all have an RWG value of 0. That means they will appear in their original order within the group. In contrast the trials within RBG groups 1 and 2 will be randomized.

Note also how trials 1, 6 and 10 each have 0's for both RWG and RBG. This means they will stay exactly where they are-in the 1st, 6th, and 10th position respectively.

As an exercise, play with the RBG and RWG values and see if you can predict the effects on the session. Just remember that the only constraint in doing this is that trials sharing the same RBG value need to be located next to each other in the input file.

## 7.3.4 Skipping

### Location

…\DirectRT\samples\3 ordering trials\skipping.csv

### Description

In some situations, you might want to skip[35] participants over a series of trials depending on their response to a given trial. To do this, simply use the symbol > and the trial ID you want to skip to, after the appropriate keycode. For example, imagine you have defined the Z key (code 44) and the / key (code 53) as valid keys. Normally you would do this by entering RT:44,53. However, if you want DirectRT to skip to Trial 34 if the participant hits the Z key (code 44), then you could enter RT:44>34,53.

Open up the input file for this sample. Notice that the first trial presents a text file[22] #preference (i.e., preference.txt). This text file contains a question asking participants which they find most attractive: 1) men, 2) women or 3) food.

Following this question are three groups of trials each presenting stimuli from one of these three categories (i.e., men, women or food). The trials involving men start at trial 2, those involving women at trial 7, and those involving food at trial 12. We want to skip the participant to one of these sections depending on how they respond to the preference question in trial 1.

Notice on the preference question (Trial 1) the valid keys are 1 (code 1), 2 (code 2) and 3 (code 3). If they respond with a 2 (i.e., code 2), this means they have indicated they find women most attractive of the three. Therefore, to skip them to the section on women (which starts at Trial 7) we indicate this with 2>7.

If they hit 3 (code 3), then we will skip them to the section on food by entering 3>12.

Since the section on men immediately follows the preference question, we do not have to use a skip value for anyone who says they find men most attractive.

Finally, notice that there is a simple single screen stimulus at the end of each section. This is an easy way to have participants all meet up at the same place after their section is complete. The screen presents a text file #continue (continue.txt) which simply says to press the spacebar to continue. We set the spacebar to be the only valid key (code 57) and we tell DirectRT to skip to trial 17 (the debriefing screen) when this key is pressed.

### 7.3.5 Jumping

**Location**

...\DirectRT\samples\3 ordering trials\jumping.csv

**Description**

In this next sample we see how to jump[37] to a later trial depending on a participant's response, execute it and then return where we left off. This is an easy way to administer feedback for particular responses.

Open the input file and notice that it is basically the same as the one we used for skipping[66]. The main difference is that for certain key press events, we have defined a jump event (you may have to widen the last Time[30] column to see everything).

In order to skip to later trials, we use the > symbol. In order to jump to a later trial and then come right back, we the < symbol.

Notice that we have added two new trials at the end. One presents the text "Incorrect Response!" and the other presents "Correct Response!" We have also indicated a series of jump instructions. Specifically, notice that on some trials, if the subject enters a 5 (code 5) then DirectRT will execute Trial 18, and on other trials Trial 19. This way we can give feedback to subjects telling them that their response was correct or incorrect.

Try running the session. Notice that you'll only jump to one of the feedback trials if you hit a key for which a jump was defined. In most of the trials here, that will only happen if you hit 5 (Very attractive). However, in the food trials, we've also included jumps if the subject enters a 1 (Very unattractive).

Important: Notice that on the debriefing trial, we have added a skip value (RT:57>999). This is done so that when DirectRT gets to this trial, hitting the space key (code 57) will skip the subject out of the session entirely (since there is no trial 999). This way, the feedback trials are never presented on their own.

Legal Note: Judgements of correct and incorrect for the purpose of this sample were assigned randomly and in no way reflect upon the actual attractiveness of the individuals or objects presented.

Congratulations! You have finished the Ordering Trials samples!

## 7.4 Applications

### 7.4.1 Pretesting Images

**Location**

...\DirectRT\samples\4 applications\stim ratings\stim ratings.csv

### Description

This sample is a simplified version of the samples used to illustrate skipping 66 and jumping 67 (it excludes the skips and jumps). It is included here because it illustrates a quick and easy way to pretest or gather ratings of images. By combining text files 22 that contain the rating scales and the images 20 to be rated on a single screen, this type of input file can be prepared very quickly.

Click to view one of the rating text files that are used for these trials: ratew.txt, ratem.txt, and ratef.txt.

As an exercise, try changing the response options, save the file and re-run the session.

Notice too that this session is run in 800x600 mode 48 (see Options 47 in the style file)

## 7.4.2 Standard Priming

### Location

…\DirectRT\samples\4 applications\standard priming\priming.csv

### Description

This sample illustrates a standard priming paradigm with very short priming intervals. Open the input file and notice that the entire session is performed by randomly drawing text stimuli from text files located in the experiment's stim folder. Remember that $ instructs DirectRT to randomly select from a StimList without replacement 23 until all the stimuli have been used.

Now open the stim folder to view the StimLists that are accessed: pos.txt, neg.txt, and neu.txt. Note that the prime is both forward and backward masked by using two different text stimuli: ~XXXXXXXXXX, and ~&&&&&&&&&&. To change the masks, just change the characters.

As an exercise, play with the display times. Currently, the first mask is displayed for 500ms and the second mask for 200. Try changing the mask characters and see what effect that has on your ability to view the prime.

See also that the order of the valid keys is different for the trials that have positive versus negative targets. This is done because the first key defines what is the "correct" response. This is not required but it is sometimes useful for data analysis becasuse whether or not the "correct" key was pressed is written to the data file 52.

Note also, that this input file utilizes Optional Fields 15. In this case, 2 additional columns have been inserted, !prime and !target, that contain stimulus factor information. These are handy for data analysis and are included in the short version of the data file 52.

Another important thing to note is the stimulus duration of the prime. It is currently set to 10ms. Remember that DirectRT displays stimuli for a number of screen display cycles. If your monitor takes 16ms to refresh its screen 6, then this is the minimum a stimulus can be displayed. However, you can enter whatever value you want. DirectRT will round the display time to the nearest screen refresh. Actual display times can be viewed in the log data file 53. This way you can see if your system is capable of the display rates you are requesting.

### 7.4.3 Priming with Images

**Location**

…\DirectRT\samples\4 applications\image priming\implicit.csv

**Description**

This sample is similar to the standard priming example[68] except that images[20] are used as primes and targets instead of text[21]. The display times are different but they don't have to be.

This sample also illustrates the use of using PowerPoint graphics[27] within your DirectRT sessions. This is very easy and quick to do. Notice how multiple PowerPoint graphics are placed sequentially in a single trial, with each requiring the press of the space bar to continue. Also note how the Block[14] value of this trial is set to 0 which means it won't be written to the data file.

### 7.4.4 Assessing Modern Racism

**Location**

…\DirectRT\samples\4 applications\modracism\modracism.csv

**Description**

This sample illustrates a very easy way to create and administer questionnaires. Check out the input file modracism.csv. Notice that the graphic called scale (scale.bmp). This is a standard scale image[20] we will use for all of the questionnaire items. We place this on each screen and then follow it with questionnaire items that are drawn randomly without replacement ($)[23] from a file called race (race.txt).

This illustrates the concept of compound screens[63]. By using a Time[30] value of 0 for the scale graphic, and a clear value of 0[28] for the subsequent questionnaire item, they are combined into a single screen that is presented at the same time.

Congratulations! You have finished the applications samples!

# 8 Other Features

## 8.1 Open Ended Responses

**Location:**

…\DirectRT\samples\5- other features\01 open ended responses

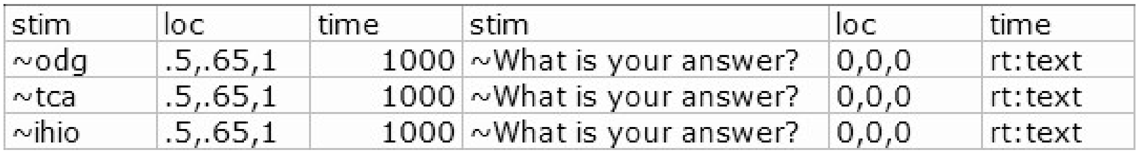
**Sample Description**

This sample demonstrates how to request an open-ended response using an anagram task. In this particular task the subject receives a very brief prime before each anagram to see how it will influence their solution. But how do we allow subjects to enter their answer when it requires more than a single key response?

Take a look at the input file, anagram.csv.

The anagrams are presented in columns O through Q. For example, the anagram odg is presented half-way across the screen and about two-thirds of the way down on a fresh screen for 1000ms.

At that point, we request an open-ended response in columns R through T. First, we specify what the question should be in the Stim 19 column (e.g., What is your answer?). The x and y coordinates will always be entered as 0's for an open-ended question, but you can specify whether you want the screen cleared (0,0,1) or not (0,0,0). In this case, we specify (0,0,0) because we want the previous anagram stimulus to stay on the screen. Finally, in the Time 30 column, we enter rt:text to indicate an open ended response.



| stim | loc | time | stim | loc | time |
|---|---|---|---|---|---|
| ~odg | .5,.65,1 | 1000 | ~What is your answer? | 0,0,0 | rt:text |
| ~tca | .5,.65,1 | 1000 | ~What is your answer? | 0,0,0 | rt:text |
| ~ihio | .5,.65,1 | 1000 | ~What is your answer? | 0,0,0 | rt:text |

**See also:**

Using Open Ended Responses as Stimuli 70

Open Ended Response Contingencies 71

## 8.2 Open Ended Responses as Stimuli

**Location:**

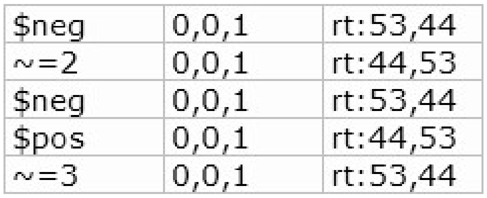
...\DirectRT\samples\5- other features\02 open ended responses as stimuli

**Sample Description**

This sample illustrates two features: (1) Taking open-ended responses, and (2) using participant responses as subsequent stimuli.

On trials 2 & 3 of the "open ended.csv" file, the subject is prompted with "What is your name?" and "What is your favourite food?" respectively. In the Time 30 column, we enter "rt:text" to indicate we want an open ended answer. Whatever the subject types here will be stored as the response. See the open-ended responses sample 69 for more detail on this procedure.

What follows are a series of priming trials. On most of the trials we are randomly selecting primes and targets from stimulus lists 23 (e.g., $pos and $neg). Notice though that on trials 6, 9, 13 & 17, we ask DirectRT to use the subject's prior responses as stimuli.



| | | |
|---|---|---|
| $neg | 0,0,1 | rt:53,44 |
| ~=2 | 0,0,1 | rt:44,53 |
| $neg | 0,0,1 | rt:53,44 |
| $pos | 0,0,1 | rt:44,53 |
| ~=3 | 0,0,1 | rt:53,44 |

On trials 6 and 13, we have entered a Stim 19 value of ~=2. This means "present a text stimulus that equals the response from trial 2". Consequently, the participant's name will appear as the target on these priming trials. On trials 9 and 17, we have entered a Stim value of ~=3. This means "present a text stimulus that equals the response from trial 3". Consequently, the subject's favorite food will appear as the target on these priming trials.

You can also use this feature to present images 20, sounds 20 or text files 22 with filenames that match closed-ended responses. To illustrate, imagine that on trial 3, instead of an open-ended response, you offered 5 different foods for the subject to choose from and they had to indicate their favourite food by pressing a letter from A to E. Your could present their response as a stimulus later on by creating 5 different text files- a.txt, b.txt, c.txt and so on, with each containing the response associated with that letter.

**See also:**

Open Ended Responses 69

Open Ended Response Contingencies 71

## 8.3 Open Ended Response Contingenices

**Location:**

...\DirectRT\samples\6- v2006\open ended response contingencies

**Sample Description**

The text response function can also add skipping 35 and jumping 37 to trials based on open-ended response 69 contingencies. It works just like it does for closed-ended responses. You can define correct and incorrect text responses and set up skips and jumps as if they were key codes, e.g.,

```
rt:text,cat<100,dog<101
```

The sample input file "retention1.csv" illustrates this function using a simple math quiz where each open ended response it evaluated as being correct or incorrect. The sample input file "retention2.csv" limits the task to 30 seconds by use of the meta command 83.

**See also:**

Open Ended Responses 69

Using Open Ended Responses as Stimuli 70

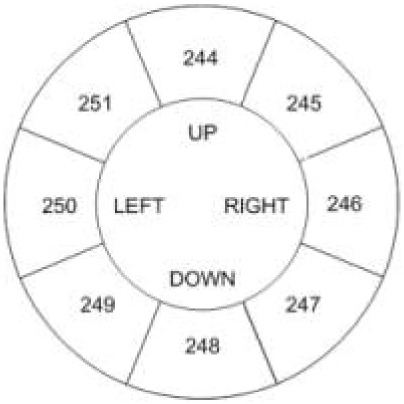
## 8.4 Joystick and Mouse Input

**Location:**

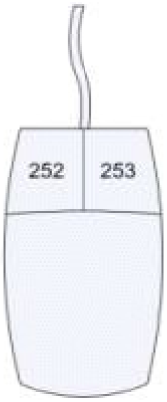
...\DirectRT\samples\5- other features\03 joystick and mouse input

### Sample Description

The joystick and mouse input functions are fairly intuitive if you've played with the regular keyboard codes. Each 45 degree joystick region has its own code that acts just like a keyboard code. Similarly, each mouse button has its own code. The codes are as follows:



JOYSTICK



MOUSE

### Also

Joystick buttons (if applicable):

Button 1 = 241

Button 2 = 242

Button 3 = 243

Other mouse buttons (if applicable):

Middle button = 254

Fourth button = 255

The "priming with joystick.csv" sample is the standard priming example but instead of hitting the z or / key, you move the joystick up for negative and down for positive (simulating an approach/avoidance reaction). You might have to calibrate your joystick if you haven't already done so. In the Windows control panel, select "gaming options" or "gaming controllers". If you don't see your joystick there you'll have to add it (e.g., by "adding" a 2-axis, 2-button joystick or whatever you have). Then click on "properties" and "settings" and then click on "calibrate". This will let you know that your joystick is working. Then you should then be ready to try the joystick sample. You'll notice in the resulting data file that the joystick response is coded as correct or incorrect depending on what response the subject made. As with regular keycodes, the first code listed tells DirectRT which code is the correct response.

The "priming with mouse.csv" sample is identical except that it uses mouse input. Instead of hitting the z or / key, you click the left or right mouse button.

### See also:

joystick continuous sample 73 for details on recording continuous discrete joystick motion

## 8.5 Joystick Continuous

### Location:

...\DirectRT\samples\5- other features\04 joystick continuous

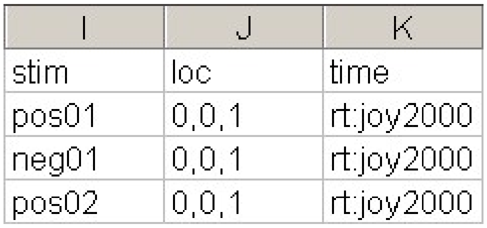
### Sample Description

DirectRT will allow you to continuously monitor (in 10ms intervals) the motion of a joystick in response to any stimulus. Note that if all you want to do is capture a discrete joystick response (e.g., up, down), then check out the sample titled "joystick and mouse input 71 ").

First, you'll have to have a joystick connected to your computer. Second, you'll need to make sure the joystick is setup in Windows. To do this, go to the windows Control Panel and select "Gaming Options". In the "Controllers" tab, click "Add" and select the type of joystick you're using (e.g., 2-axis, 2 button). Then click "Properties, Settings, Calibrate" from the same tab. Calibrate the joystsick according to the instructions and now you're ready to try the sample.

This sample displays images and records negative and positive responses via the joystick using push and pull motions respectively. It will assess joystick action instead of waiting for a key response. Try the "joystick.csv" sample input file and when each picture appears, move the joystick around. After 8 images, the session will end.

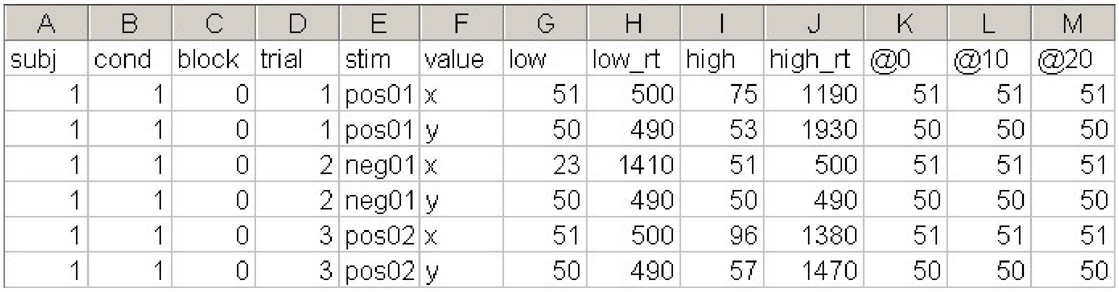
So how do you create the experiment? If you open the "joystick.csv" input file you'll see it looks just like any other input file. The difference is that in the Time 30 column, you request "RT:joy2000" for a joystick response of 2000 ms (or RT:joy1500 for 1500ms, etc.). That's the only difference. That tells DirectRT to assess continuous joystick responding instead of waiting for a key or other type of input.



| I | J | K |
|---|---|---|
| stim | loc | time |
| pos01 | 0,0,1 | rt:joy2000 |
| neg01 | 0,0,1 | rt:joy2000 |
| pos02 | 0,0,1 | rt:joy2000 |

Since monitoring continuous joystick motion creates many data points, a separate data file is dedicated to storing these data. You will find the resulting data in the sample's data folder in a file called "joystick.txt". To open this file in Excel, you will need to select "All Files" in the "Files of Type" box when trying to find it. Then, tell Excel you want to open it as a tab-delimited data file. Note that you can also open tab delimited data files in SPSS in case you have more than 255 variables which is Excel's limit. This will be necessary if you monitor the joystick for much more than two seconds since a data point is written every 10ms (i.e., 2 seconds = 200 data points).

This is an illustration of what the data might look like:



| A | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| subj | cond | block | trial | stim | value | low | low_rt | high | high_rt | @0 | @10 | @20 |
| 1 | 1 | 0 | 1 | pos01 | x | 51 | 500 | 75 | 1190 | 51 | 51 | 51 |
| 1 | 1 | 0 | 1 | pos01 | y | 50 | 490 | 53 | 1930 | 50 | 50 | 50 |
| 1 | 1 | 0 | 2 | neg01 | x | 23 | 1410 | 51 | 500 | 51 | 51 | 51 |
| 1 | 1 | 0 | 2 | neg01 | y | 50 | 490 | 50 | 490 | 50 | 50 | 50 |
| 1 | 1 | 0 | 3 | pos02 | x | 51 | 500 | 96 | 1380 | 51 | 51 | 51 |
| 1 | 1 | 0 | 3 | pos02 | y | 50 | 490 | 57 | 1470 | 50 | 50 | 50 |

Each trial has two rows--a series of X-values and a series of Y-values. Each row tells you the Subject and Condition IDs from the session. It labels the Block and Trial IDs as well. It then tells you the stimulus (image names in this case) and whether the row contains the X values or Y values. It then tells you the lowest value from 1-100 that occurred on that trial. 1 is far left for X and far down for Y. 100 is far right for X and far up for Y. It then tells you the time at which that lowest value was reached in milliseconds and does then the same data are shown for the high values.

Then, you will see the raw data. These data show you the X (or Y) position of the joystick in 10ms intervals across the stimulus display interval (in this case, 2 seconds)

### Discreet and Continuous at Same Time

By simply indicating the number of milliseconds you want to monitor as a negative value such as RT:JOY-2000, DirectRT will take a discrete RT also record any motion activity for up 2000ms.

## 8.6 LightGun, TouchScreen, Cursor

### Location:

…\DirectRT\samples\6- v2006\lightgun

…\DirectRT\samples\6- v2006\cursor

…\DirectRT\samples\6- v2006\touchscreen

### Sample Description

These samples demonstrate how to define regions of the screen and associate key codes with them. After that you can treat the regions just like key presses. Samples are included for use with a mouse, a light gun and a touch screen.

### Using Mouse Cursor Functionality in DirectRT

DirectRT can receive screen location input using "area" codes that function just like keycodes. The following instructions will work with most standard mice, lightguns and touchscreens. Follow these steps to activate the functionality with DirectRT. First, using the Windows Notepad or other text editor, create a simple text file in your experiment folder called "cursor.txt", "lightgun.txt", or "touchscreen.txt" depending on which input source you are using. This file should be in the same folder as your input file. The presence of this file tells DirectRT that you want to use the screen area functionality. In this file, you can define up to 255 areas on your screen. It's basically a list of rectangle coordinates on your screen which you define based on the screen resolution in which you'll be running your experiment. For example, say you are running your input file in 800x600 display mode 48 (set from "Options 47" in your Style file). You could create four areas that correspond to the four quadrants of the screen like this:

```
ID X Y W H

1, 1, 1, 400, 300

2, 401, 1, 400, 300

3, 1, 301, 400, 300

4, 401, 301, 400, 300
```

Each row is an "area". The first number is the area ID, which will function in your input file like a keycode. The second and third numbers are the x and y positions where the area starts (i.e., the top left corner). Finally, the fourth and fifth numbers are the width and height of the area. These numbers again are based on an 800x600 display--you would change them accordingly for a different display (e.g., 1024x768). Basically this means you can define as many rectangles of any size and location as you like. Importantly, each area gets an ID value--a number from 1 to 255. The ID's are important because you use these just like you would use keycodes in your input file. So if you wanted to specify that areas 1, and 3 (above) are valid for a particular trial and that area 3 is the correct response, then you simply say "rt:3,1"--just like keycodes.

The key benefit of doing it this way is that you will be able to utilize all of the features that are associated with the keycode method, such as skips and jumps and identifying the correct response simply by listing it first, requiring a correct response if desired, etc. Another benefit of doing it this way is that you can create a set of valid areas for any trial and in so doing, you can *exclude* areas from counting as valid areas. An example of this would be a case where you create 5 graphic "areas" on screen and you want the subject to select one. With this new method, you would add 5 areas to your text file that correspond to where these areas will be on screen. You then list those id's on that trial as valid responses, listing the correct one first. Responding to the screen in an area that is not one of these valid areas will not count as a response. In other words, the subject would actually have to select a valid target area.

## 8.7 Require Correct Responses

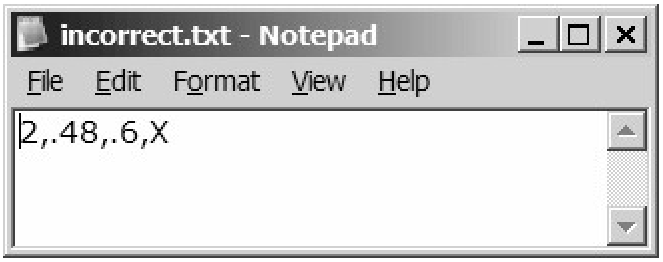
### Location:

…\DirectRT\samples\5- other features\05 require correct response

### Sample Description

In some cases you may want to require that the subject respond with the correct key before continuing. To accomplish this you can create a short text file called "incorrect.txt" in your session folder that tells DirectRT to take a special action when valid but incorrect keys are hit. Using this method, if the subject hits a valid but incorrect key then a prompt that you define will appear to tell subjects their response was incorrect and that they need to hit the correct key to continue.

Try running the sample input file "priming.csv." It is the standard priming sample 68 with the exception that the following text file called "incorrect.txt" is located in the session folder:



```
2,.48,.6,X
```

If DirectRT sees the "incorrect.txt" file in your session folder, then it will know to require a correct response on trials. This text file contains 4 values. The first is the style ID 42 that you want to apply to the prompt that occurs when an incorrect response happens. The second value is the x-coordinate for the prompt and the third is the y-coordinate. The fourth value is the prompt itself. So in this case, when an incorrect response occurs, an "X" will appear 48% of the way across the screen and 70% of the way down, and it will appear in Style 3.

Some notes about requiring correct responses:

- The data file will reflect the response time to hit the correct key
- The key code recorded will be that of the correct key
- You can identify that an incorrect key was pressed first by looking in the "Correct" column-those trials on which an incorrect key was pressed first will be labeled as "False.'
- The style you apply to the incorrect response prompt should usually have a MinMax 45 value of 0. This will inhibit DirectRT from prompting subjects to go faster after hitting the correct key. This might be desirable since they probably feel bad enough that they got the answer wrong.
- The incorrect prompt will never be applied to any response that only has one valid response option (including rt:any) . This makes it easy to include instructions screens without the risk of an inappropriate prompt.

### See Also:

GNAT - No Response As Valid 76

## 8.8 GNAT - No Response as Valid

### Location:

…\DirectRT\samples\6- v2006\no response as valid

…\DirectRT\samples\6- v2006\gnat

### Sample Descriptions

You can use -1 as a keycode 93 to represent "no response" as if it were just like any other keypress. That means you can list it with other keycodes, either first to indicate it's the correct answer or later in the list to indicate that it's incorrect. If the subject waits as long as the max value in the MinMax field 45 of the style for that stimulus then that's like pressing the "-1" key.

The first sample input file "noresponse.csv" in the "no response as valid" folder shows how to do this in the simplest way possible:

```
    ~no response       0,0,1       rt:-1,57

    ~hit space         0,0,1       rt:57,-1
```

Here we see that no response is correct for the first trial, and hitting the space bar is correct for the second.

### GNAT

The GNAT sample files in the "gnat" folder are the DirectRT version of the Go/No-go Association Task (GNAT) posted at Project Implicit (see http://projectimplicit.net/nosek/gnat/)

In them, you'll see:

rt:57,-1<-999

rt:-1,57<-999

57 as usual is the keycode for the spacebar. -1 is the new code used to represent no response. <999 normally means jump to trial 999 when the trial is over and then resume. If you add a negative sign as in <-999, DirectRT will jump RIGHT AWAY without finishing the trial. The subject never sees the rest of the trial. Trial 999 is the X. So if you don’t jump immediately to 999 (and get the X) then you get the O which is at the end of each trial.

Note: see http://www.empirisoft.com/support/showthread.php/94-Min-max-values-being-ignored for notes regarding a bug that had the potential to affect the 'no response' option in versions 2006.1.12 - 2006.1.15.

## 8.9 Key Release RTs

### Location:

…\DirectRT\samples\5- other features\06 key release rts

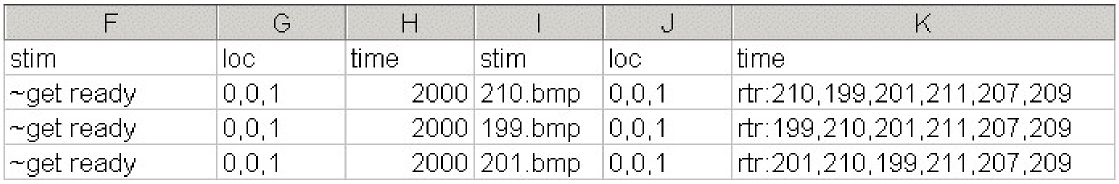
### Sample Description

In some paradigms, the subject is required to hold a key down prior to their response. When the time comes to react, the subject releases this key and responds as quickly as possible by hitting another key. This sample demonstrates such a task and shows how you can record the amount of time it took for the subject to release the first key **and** how long it then took to hit the response key.

Try running the sample input file "keyrelease.csv." You will be asked to press down on the space bar whenever you see the words "get ready" appear. You will then see a 3x2 grid appear that corresponds to the 6 keys: insert, home, pageup, delete, end, and pagedown. An X will appear in one of these cells and your task is to release the space bar and hit the key that matches the location of the X as quickly as possible. You will then return your finger to the space bar for the next trial.

When you open up the data file for the "keyrelease.csv" file, you'll see a column called "Release"--this is the number of milliseconds it took you to release the space bar from the time the image first appeared. The RT column is the reaction time to hit the correct (or incorrect) key which also starts from the time the image appears.

So how do we accomplish this? Take a look at the "keyrelease.csv" input file. You'll see that the only thing unusual in here is that in the Time 30 column, you have "RTR:" instead of "RT:" for your trials. This essentially stands for "ReactionTime with ReleaseTime".



| F | G | H | I | J | K |
|---|---|---|---|---|---|
| stim | loc | time | stim | loc | time |
| ~get ready | 0,0,1 | 2000 | 210.bmp | 0,0,1 | rtr:210,199,201,211,207,209 |
| ~get ready | 0,0,1 | 2000 | 199.bmp | 0,0,1 | rtr:199,210,201,211,207,209 |
| ~get ready | 0,0,1 | 2000 | 201.bmp | 0,0,1 | rtr:201,210,199,211,207,209 |

The previous stimulus in each trial (i.e., ~get ready) is simply a text prompt so that subjects have time to press down on the space bar (or any other key you instruct subjects to hold down). When you specify an RTR response, DirectRT will check to see if a key is being held down when the RT starts. If so, it will record the time it took for the subject to release that key and write it to the data file in a column labeled "Release". The response time for the subsequent response is independent of the release time (i.e., it begins at the onset of the stim and consequently includes the key release time).

## 8.10 Clear Screen During an RT

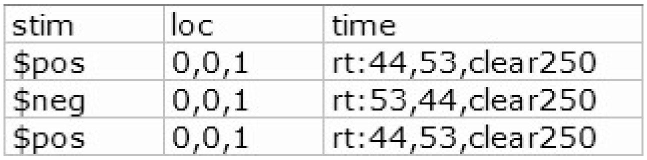
### Location:

…\DirectRT\samples\5- other features\07 clear screen during an rt

### Sample Description

Normally, when you request an RT, the stimulus remains on the screen until the response is received. In some cases, you may want to fix the time the stimulus is displayed regardless of how long it takes the subject to respond. You can do this using the "clear" function. This instructs DirectRT to clear the screen after a specified number of milliseconds even if the subject has not yet responded.

Try running the sample input file "priming.csv" contained in this folder. You will find that when you are required to respond, you will see the last stimulus for only 250ms, no matter how long you take to hit a key. Even though the stimulus has disappeared, the RT clock keeps going. This is accomplished with the input file as follows:



| stim | loc | time |
|---|---|---|
| $pos | 0,0,1 | rt:44,53,clear250 |
| $neg | 0,0,1 | rt:53,44,clear250 |
| $pos | 0,0,1 | rt:44,53,clear250 |

After listing the valid keys, we enter "clear250" to indicate that the screen should be cleared after 250ms. This has only a visual impact-it has no effect on the RT being collected.

You might wonder, "why not just display the stim for 250ms and then take the RT?" The answer to this is, "what if the subject can respond in less than 250ms?" The benefit of doing it this way is that it allows a response to occur both before and after the moment when the stim is cleared. If we were to display the stim for 250ms and then take the RT, we could only get responses greater than 250ms. The usefulness of this is even more pronounced when fixed display times become greater (e.g., clear500, clear1000, etc.).

**Note:**

Another use of the Clear command is to clear the screen after the response occurs when using a fixed response window. See the MinMax 45 command for details.

## 8.11 Key Press Feedback

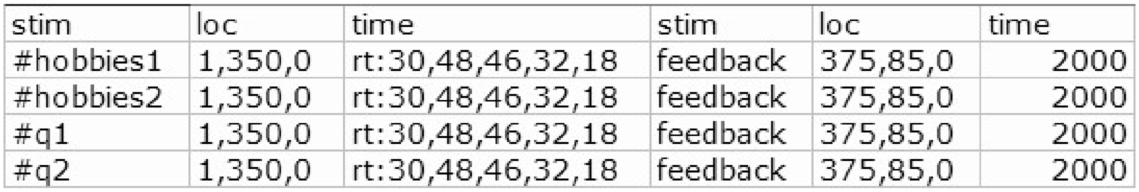
**Location:**

...\DirectRT\samples\5- other features\08 keypress feedback

**Sample Description**

Response Feedback allows you to display the response key that is hit as a form of visual feedback to subjects. You can request that the key name be displayed after an RT is taken by entering "feedback" in a subsequent Stim 19 column. Using the Location 28 column you can specify where the feedback should appear and whether the screen is cleared or not before the feedback appears. Using the Time 30 column you can specify how long the feedback should be displayed before continuing to the next stimulus or trial. For example, following a reaction time, if you enter a Stim value of "feedback", a Loc value of ".5,.5,0" and a Time value of "2000", then the subject's response will appear in the middle of the screen for 2000ms. The style used to present the feedback will be the default style for the trial unless you specify an alternate style in angular brackets 19 (e.g., "feedback <2>" will present the feedback in style #2 from the experiment's style file).

Try running the sample input file "feedback.csv" contained in this sample folder. You will see that each time you answer an question, they key you pressed will appear on the screen. This is accomplished with the input file as follows:



| stim | loc | time | stim | loc | time |
|---|---|---|---|---|---|
| #hobbies1 | 1,350,0 | rt:30,48,46,32,18 | feedback | 375,85,0 | 2000 |
| #hobbies2 | 1,350,0 | rt:30,48,46,32,18 | feedback | 375,85,0 | 2000 |
| #q1 | 1,350,0 | rt:30,48,46,32,18 | feedback | 375,85,0 | 2000 |
| #q2 | 1,350,0 | rt:30,48,46,32,18 | feedback | 375,85,0 | 2000 |

On each trial, a question is asked that requires one of the keys, a though e, be pressed. After that, we request that response feedback be displayed for 2000ms by entering "feedback" in the Stim column and 2000 in the Time column. The Loc column specifies where the feedback should be displayed (375 pixels to the right, and 85 pixels down) and that the screen should not be cleared (0) so that the feedback appears on the same screen as the question. A Loc value of "375,85,1" would have the same result with the exception that the feedback would appear on a fresh screen.

**See also:**

Using open-ended responses as stimuli 70

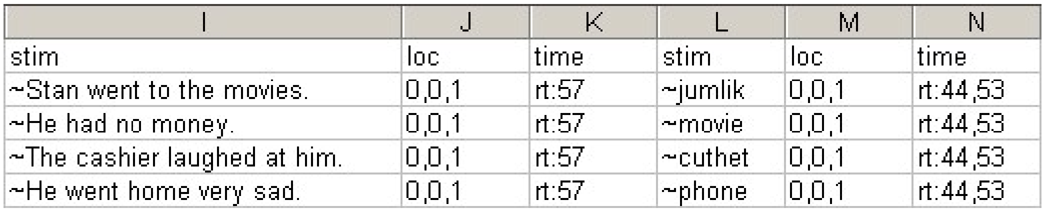
## 8.12 Multiple RTs

**Location:**

...\DirectRT\samples\5- other features\09 multiple rts

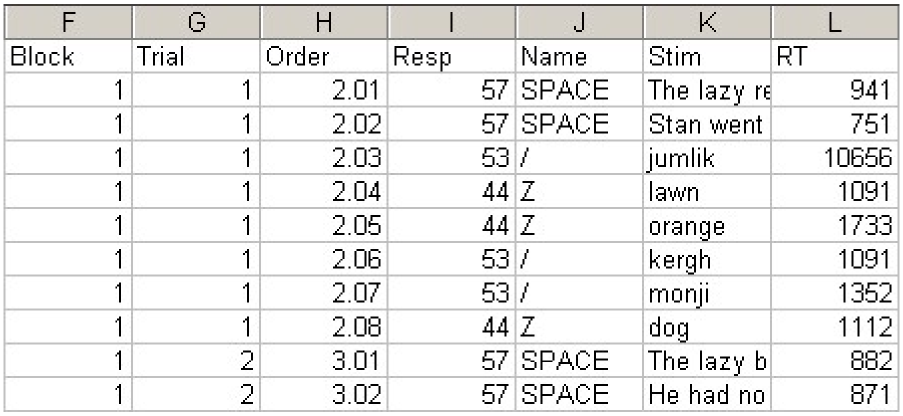
### Sample Description

DirectRT will record multiple RTs on a single trial if you request it. Take a look at the sample input file "lex1.csv" in this folder and you will see that each trial requests 8 RTs. The following excerpt shows two of the eight sequential RTs:



| I | J | K | L | M | N |
|---|---|---|---|---|---|
| stim | loc | time | stim | loc | time |
| ~Stan went to the movies. | 0,0,1 | rt:57 | ~jumlik | 0,0,1 | rt:44,53 |
| ~He had no money. | 0,0,1 | rt:57 | ~movie | 0,0,1 | rt:44,53 |
| ~The cashier laughed at him. | 0,0,1 | rt:57 | ~cuthet | 0,0,1 | rt:44,53 |
| ~He went home very sad. | 0,0,1 | rt:57 | ~phone | 0,0,1 | rt:44,53 |

After running this sample, take a look at the resulting data file 52. You will see that only one RT has been recorded for each trial-the final one. In order to view and analyze data from input files that assess multiple RTs, you will need to use the log data file 53, located in the "Log" subfolder of the data folder. Open the log version of the data file and you will see the data for each of the eight RTs on every trial:



| F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|
| Block | Trial | Order | Resp | Name | Stim | RT |
| 1 | 1 | 2.01 | 57 | SPACE | The lazy re | 941 |
| 1 | 1 | 2.02 | 57 | SPACE | Stan went | 751 |
| 1 | 1 | 2.03 | 53 | / | jumlik | 10656 |
| 1 | 1 | 2.04 | 44 | Z | lawn | 1091 |
| 1 | 1 | 2.05 | 44 | Z | orange | 1733 |
| 1 | 1 | 2.06 | 53 | / | kergh | 1091 |
| 1 | 1 | 2.07 | 53 | / | monji | 1352 |
| 1 | 1 | 2.08 | 44 | Z | dog | 1112 |
| 1 | 2 | 3.01 | 57 | SPACE | The lazy b | 882 |
| 1 | 2 | 3.02 | 57 | SPACE | He had no | 871 |

The log file allows you to differentiate between the multiple RTs with the "Order" column. Normally, the order column tells you the ordinal position in which the trial occurred in the session. In this sample, the trial labeled Block 1, Trial 1 was the second trial to occur (the instruction screen was the first but since it has a Block value of 0, it is not written to the data file). When recording multiple RTs, the order column also tells you which RT the data refer to. 2.01 refers to the first RT, 2.02 refers to the second, 2.03 to the third and so on up to 2.08 which refers to the eighth and final RT for that trial.

### See Also

Require Multiple Key Presses 80

## 8.13 Require Multiple Keypresses

### Location:

…\DirectRT\samples\6- v2006\require multiple keypresses

### Sample Description

With the use of an external text file, e.g., rt1.txt, you can list separate sets of valid keycodes[93] for a SINGLE stimulus. Doing so will require the participant to hit a valid keycode from each set. This will allow you to take two simultaneous keys for each response--and you'll be able to get the RT for each no matter which one comes first (even if the difference is a small number of milliseconds).

In the sample external text file "rt1.txt" in the stim folder, we see two sets of valid codes: the z (44) or x (45) key, and then the . (52) or / (53) key.  This means that one key from each set will be required as a response.

In the input file "double.csv," see that where we would normally say "RT:..." we say "RT1:44,53"

This means that we want to use the rt1.txt file in order to use rt key sets (any value up to "RT9" can be used for the text file). The 44 indicates that the correct response from set 1 is 44 (z), and that the correct response from set 2 is 53 (/).  You can add or change the keycodes in the rt1.txt file as you like.  You can also change which keys are correct in the input file.

### See Also

Multiple RTs[79]

## 8.14 Using Previous Stim

### Location:

…\DirectRT\samples\5- other features\10 using previous stim

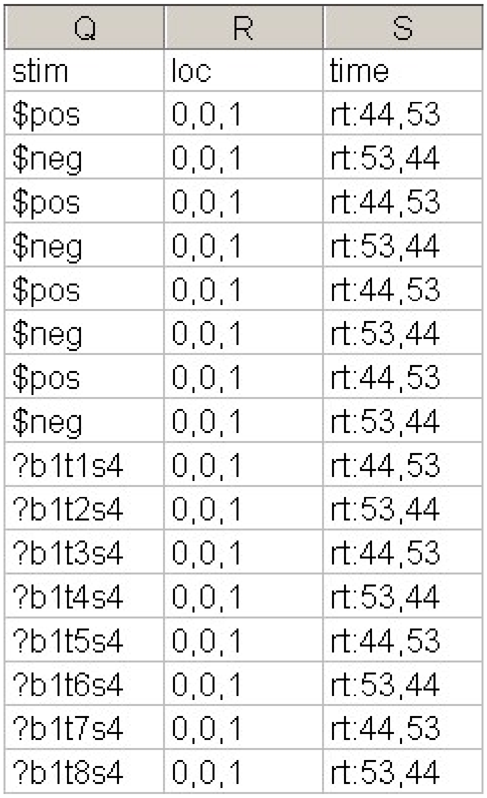
### Sample Description

In special cases you might want to instruct DirectRT to use a stimulus from a previous trial without knowing exactly what that stimulus will be when you design your input file. This could happen, for example, when a stimulus is randomly determined on one trial but then you want to repeat that trial. On the later trial you can simply tell DirectRT which stimulus you want to repeat. You are essentially saying, "use the third stimulus from block 2, trial 5--whatever it was!" To do so, you can use the "?" operator which means to use a previous stimulus, no matter whether it was randomly chosen or not. To refer to a previous stimulus, you just need to know the block (b), trial (t) and stimulus (s) IDs. For example if you want to use block 1, trial 3, stimulus 4 in a later trial, you would request: "?b1t3s4" in the stim column.

The sample input file "priming.csv" included in this folder illustrates this feature. Try running it. Notice the prime-target pairings used in the first 8 trials-the pairings are randomly chosen. Then watch the next 8 trials. The order of the trials is randomized-but the pairings are the SAME as they were in the first 8 trials!

### How was this accomplished?

In this sample, primes and targets for the first 8 trials are all randomly selected without replacement from a stimlist[23]. That's nothing unusual if you've been looking through the many priming samples. What's new is that we want to repeat this block of trials again with the same prime target combinations. The graphic below shows the targets which are the 4th stimulus on each trial. On the first 8 trials, you can see that they are randomly selected from a stim list (i.e., $pos and $neg). The next 8 trials use the "?" operator to find out what the previous targets were and inserts them. For example, on the 9th trial, the Stim column reads "?b1t1s4" --this means show the 4th stimulus from Block 1, Trial 1. We don't show it here, but the prime on this trial reads "?b1t1s2" which means to show the 2nd stimulus from Block 1, Trial 1. This results in Block 2, Trial 1 being identical to Block 1, Trial 1. Using block-specific RWG values 17, each block is randomized separately. Voila! We're done.



| Q | R | S |
|---|---|---|
| stim | loc | time |
| $pos | 0,0,1 | rt:44,53 |
| $neg | 0,0,1 | rt:53,44 |
| $pos | 0,0,1 | rt:44,53 |
| $neg | 0,0,1 | rt:53,44 |
| $pos | 0,0,1 | rt:44,53 |
| $neg | 0,0,1 | rt:53,44 |
| $pos | 0,0,1 | rt:44,53 |
| $neg | 0,0,1 | rt:53,44 |
| ?b1t1s4 | 0,0,1 | rt:44,53 |
| ?b1t2s4 | 0,0,1 | rt:53,44 |
| ?b1t3s4 | 0,0,1 | rt:44,53 |
| ?b1t4s4 | 0,0,1 | rt:53,44 |
| ?b1t5s4 | 0,0,1 | rt:44,53 |
| ?b1t6s4 | 0,0,1 | rt:53,44 |
| ?b1t7s4 | 0,0,1 | rt:44,53 |
| ?b1t8s4 | 0,0,1 | rt:53,44 |

## 8.15 Yoking Random Pairs

### Location:

…\DirectRT\samples\6- v2006\yoking random pairs

### Sample Description

This sample demonstrates how to present a stimulus paired with a previous stimulus, when that previous stimulus was randomly chosen. This gets around the fact that you do not know in advance what the previous stimulus was.

In the past it was difficult to randomly choose a stimulus from a list and then subsequently present a paired or matched stimulus from different list. DirectRT now makes this easy by allowing you to say "pick the item from this list that matches the position of the item I just randomly chose from that list!" Say for example, you want to use a randomly chosen prime/target pairing, where primes and targets are each in their own lists. Choose a random prime as usual by requesting $prime. Then simply ask for &target^-1. Using the & symbol you are requesting a specific item from a list. The -1 value tells DirectRT to use the position equal to the position of the last random stimulus chosen. Use greater negative values to match random picks from farther back.

On each trial in the sample input file "yoking.csv," a voice file is randomly chosen at the start of each trial. The subsequent stimuli for the trial are all chosen as a function of which voice file was chosen.  Try the sample and see--e.g., if the third voice file is chosen, then the subsequent stimuli include the third behavioral description, and third question from each of the question lists.

## 8.16 Meta Commands

**Location:**

…\DirectRT\samples\6- v2008\meta commands

**Sample Description**

Version 2006 introduced the Meta Command. These are commands you can use that span multiple trials. Simply create a !Meta column in your input file and place any meta commands you like there.

For example, say you want the session to end 5 minutes after the first trial begins. Simply enter "end:300000" in the Meta column for the first trial. Or you might want the session to skip to a particular block after a fixed time expires--you would enter">300:60000" to tell DirectRT to skip to trial 300 after 60 seconds has elapsed from this point. We'll be adding new meta commands as we think of them and feel free to request one.

Thie "metacommands.csv" sample input file illustrates a timed math task embedded within remember/know (old/new) task. Note that the time-based skip is started at the onset of the trial from which it is called and is executed when the time expires. The skip will occur no matter where DirectRT is but will wait until the current trial has been completed (it will not interrupt a session mid-trial).

In our example, we tell DirectRT to skip to trial 111 after the math task has been executing for 30 seconds. Trial 111 is the instruction set for the next task.

## 8.17 Play Sounds

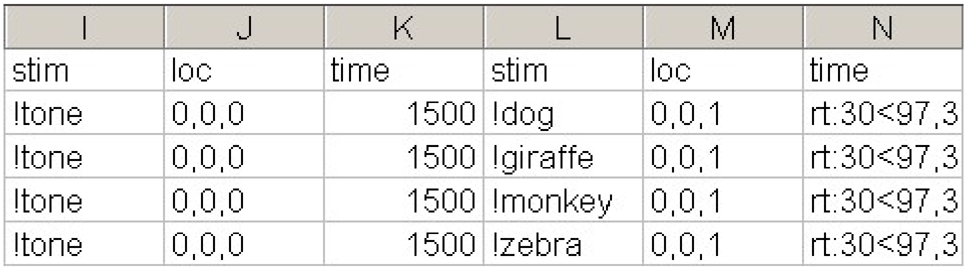
**Location:**

…\DirectRT\samples\5- other features\11 play sounds

**Sample Description**

DirectRT allows you to play sound files and to synchronize them with other events and stimuli in your session. Try running the "sound.csv" sample input file in this folder. If your speakers are on (or your headphones are plugged in) and your volume is turned up, then you should hear the sound files play during the session. On most machines, you can adjust the volume by clicking on the little speaker icon on the Windows task bar. If you do not have this icon, then you can type "sndvol32" from the Run command on the Windows Start menu to adjust the volume.

Playing sound files in DirectRT is accomplished the same way every other stimulus is presented-by listing the sound file name in the Stim 19 column. To tell DirectRT that it should be looking for a sound file, precede the filename with "!' like this:



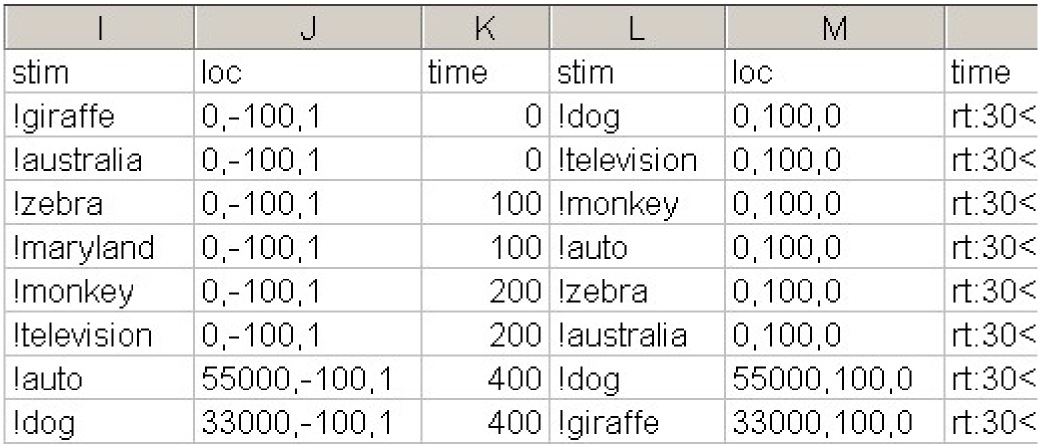
| I | J | K | L | M | N |
|---|---|---|---|---|---|
| stim | loc | time | stim | loc | time |
| !tone | 0,0,0 | 1500 | !dog | 0,0,1 | rt:30<97,3 |
| !tone | 0,0,0 | 1500 | !giraffe | 0,0,1 | rt:30<97,3 |
| !tone | 0,0,0 | 1500 | !monkey | 0,0,1 | rt:30<97,3 |
| !tone | 0,0,0 | 1500 | !zebra | 0,0,1 | rt:30<97,3 |

On these trials, DirectRT will first look in the stim folder for a sound file called "tone.wav". It will play this file and from the moment it begins, 1500ms will elapse before DirectRT continues with the next stimulus. In this case, the next stimulus is another sound file (e.g., dog.wav, giraffe.wav). Note that the second sound file on each trial request an RT rather than a time interval in the Time[30] column. When this happens, DirectRT will start timing the RT from the moment the sound file begins playing.

Note that you will usually enter "0,0,0" in the Loc[28] column if you simply want to play the sound file without clearing the screen, and "0,0,1" if you want the screen cleared when the sound begins. DirectRT has advanced sound functions though which you can control by entering values different from these in the Loc column.

### Advanced Sound Functions

By using special values in the Loc column (i.e., instead of 0,0,0 or 0,0,1), you can control three aspects of the how the sound files are played: Frequency, Pan and Volume. Try running the "dichotic.csv" sample input file in this folder. To get the full effect, try to use stereo speakers--or even better, a pair of head phones. You'll notice that certain sounds play in the left channel and some in the right. On the last two trials, the sounds are either sped up or slowed down. How are these effects accomplished? Here is an excerpt from the "dichotic.csv" input file:



| I | J | K | L | M | |
|---|---|---|---|---|---|
| stim | loc | time | stim | loc | time |
| !giraffe | 0,-100,1 | 0 | !dog | 0,100,0 | rt:30< |
| !australia | 0,-100,1 | 0 | !television | 0,100,0 | rt:30< |
| !zebra | 0,-100,1 | 100 | !monkey | 0,100,0 | rt:30< |
| !maryland | 0,-100,1 | 100 | !auto | 0,100,0 | rt:30< |
| !monkey | 0,-100,1 | 200 | !zebra | 0,100,0 | rt:30< |
| !television | 0,-100,1 | 200 | !australia | 0,100,0 | rt:30< |
| !auto | 55000,-100,1 | 400 | !dog | 55000,100,0 | rt:30< |
| !dog | 33000,-100,1 | 400 | !giraffe | 33000,100,0 | rt:30< |

To speed up or slow down the sound file, you can set the frequency in hertz (Hz) at which the sound is played by entering a value from 100 to 100000. In the first six trials, this value is set to 0-which indicates to use the default frequency of the sound file. However, the seventh trial, the frequency of the sounds are set to 55000Hz-significantly higher than the default frequency of 44000Hz. In contrast, on the eighth trial, the frequency of the sounds are set to 33000Hz-significantly lower than the default frequency.

To control whether a given sound is dominant in the right or left channel, you can set a Pan value anywhere from -100 (left only) to 100 (right only). Note that the sounds in the first stim column have a pan value of -100. Consequently, they will play in the left channel only. In contrast, the sound files in the second stim column have a pan value of +100-meaning they will play only in the right channel. Other examples: A value of 50 would result in the right channel being at full volume and the left at half volume. A value of -75 would result in the left channel being at full volume and the right channel being at 25% volume.

Finally, to control the overall volume at which the sound file is played, you can enter a value from 0 (normal) to -100 (completely muted). Sounds can only be reduced in volume and not amplified.

Note that in this sample an added effect of delay is achieved by entering variable values in the Time column of the first sound. When this value of 0, the two sounds play nearly simultaneously. When the value is 100, there is a 100ms delay between the sounds. When it's 200, there is a 200ms delay, and so on. This occurs because the value in the Time column for a sound determines how many milliseconds DirectRT will let pass before continuing with the next stimulus.

## 8.18 Voice RTs

### Location:

…\DirectRT\samples\5- other features\12 voice responses stroop

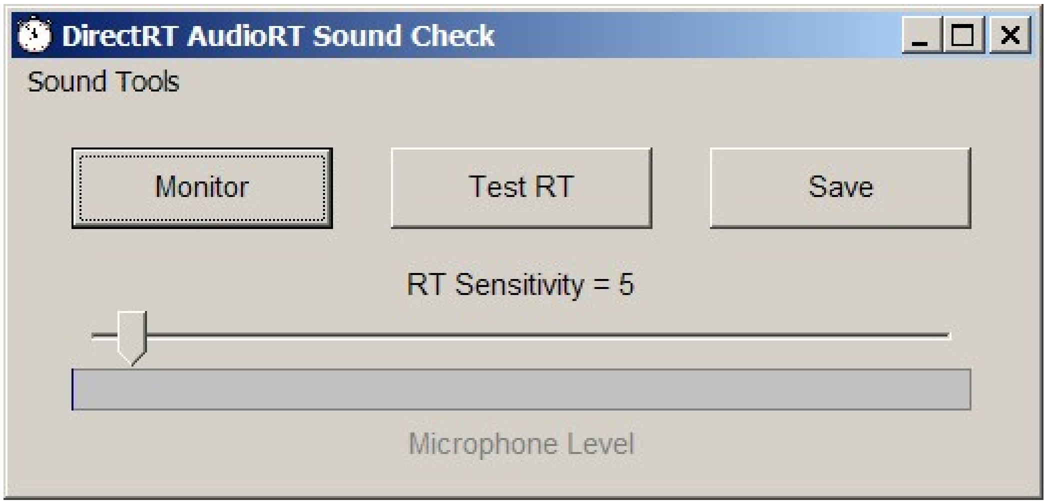
### Sample Description

These samples illustrate how to assess reaction times through a microphone connected to your sound card and how to optionally record voice responses as sound files on your hard drive.

### Collecting Voice Responses

With all of the voice response methods, you will need to make sure you have a microphone connected to the microphone input connector on your sound card. You will also need to make sure that the microphone is active and able to record. Finally, you will need to tell DirectRT how sensitive it should be in detecting response times.

To make all this easier, DirectRT comes with a tool called SoundCheck, which can be located on the Tools menu of DirectRT. When you run SoundCheck, this is what you'll see:



RT Sensitivity = 5

After making sure your microphone is plugged into your soundcard, click "Monitor" and speak into the microphone. If all is well, you should see the bar labeled "Microphone Level" respond immediately to your voice. If that works, then click "Stop" to end the monitoring. Now try a sample voice rt. Click "Test RT" and then speak into the microphone. SoundCheck should report the response time in milliseconds.

If you need to speak too loudly to set off the test, then try moving the sensitivity slider toward the left. If the test is set off too easily, then try moving the sensitivity slider toward the right. Try this until you find an RT sensitivity that works well for you. When you are happy with the sensitivity, click "Save." This will make the new sensitivity level available to DirectRT when you run a session with voice responses.

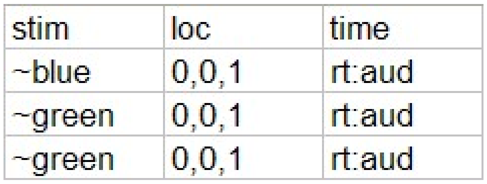
It is advisable to run a few test RTs on any machine before running a DirectRT session with voice responses for the first time. When running the samples in this folder, if you repeatedly get the message "please wait for the stimulus" this means the RT sensitivity value is set too low. Alternatively, if you repeatedly get the message "please try to respond faster" then the RT sensitivity value is set too high.

Note that the SoundCheck program provides access to other sound utilities by clicking on "SoundTools" in the top left corner. Access to these additional tools is provided here in case you have problems with your test RTs.

## Voice Response Methods

### *Automatic Continuation Method*

The easiest to implement of all the voice response methods, this traditional method instructs DirectRT to simply wait until a voice response occurs and then to immediately continue with the next stimulus or trial. This is illustrated in the sample input file "stroop automatic.csv:"

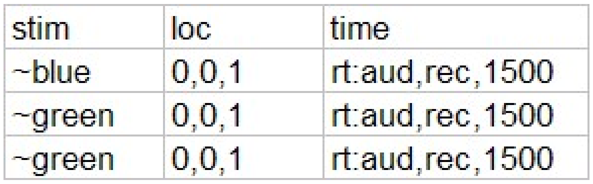


| stim | loc | time |
|---|---|---|
| ~blue | 0,0,1 | rt:aud |
| ~green | 0,0,1 | rt:aud |
| ~green | 0,0,1 | rt:aud |

Notice that for a voice RT, all we need to do is enter "rt:aud" in the time column. In place of keycodes 93, we tell DirectRT to wait for auditory input from the sound card.

### *Fixed Time Method*

With the fixed time method, you specify the amount of time you want DirectRT to monitor the microphone. This time period can range from 100ms up to much longer periods (e.g., 5 minutes, or 300000ms). You can also request that DirectRT save the incoming sound as a .wav sound file in a folder so you can listen to it later. Take a look at the sample input file "stroop fixed.csv" in this folder. We see that on each trial, a voice response is requested by entering "rt:aud" in the Stim 19 column, followed by the fixed amount of time we want DirectRT to monitor the microphone. In this case, we ask DirectRT to monitor the microphone for 1500ms. In this sample, we also ask DirectRT to save the incoming sound on each trial as a sound file by inserting "rec" (short for "record") which could optionally be omitted.

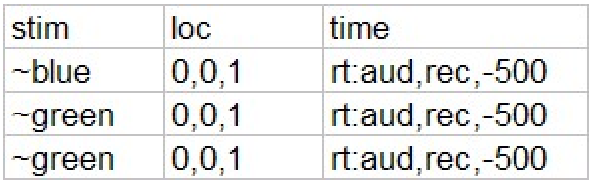


| stim | loc | time |
|---|---|---|
| ~blue | 0,0,1 | rt:aud,rec,1500 |
| ~green | 0,0,1 | rt:aud,rec,1500 |
| ~green | 0,0,1 | rt:aud,rec,1500 |

When the response is set to begin, DirectRT begins monitoring the incoming sound and keeps doing so until the time limit you set has expired. When the time limit expires, DirectRT will continue with next stimulus or trial. If you requested that DirectRT save the sound (using "rec"), then it will be saved to the data folder so that you can listen to it later for coding, response verification, or some other purpose.

### *Combo Method*

A third option combines the first two. In this method, DirectRT will wait until a voice response has occurred and then-from that point-will wait an additional period of time that you specify. For example, if you want DirectRT to continue 500ms after each response then you can specify this the same way as with the Fixed Time method, but with a negative time value. The negative time value tells DirectRT that you want the Combo Method rather than the Fixed Time method. This is illustrated in the sample "stroop combo.csv:"



| stim | loc | time |
|---|---|---|
| ~blue | 0,0,1 | rt:aud,rec,-500 |
| ~green | 0,0,1 | rt:aud,rec,-500 |
| ~green | 0,0,1 | rt:aud,rec,-500 |

This method is especially useful if you want to proceed immediately after participants respond, but you also want to save participants' verbal responses as sound files. By specifying an additional fixed time, DirectRT will continue recording just long enough to capture the verbal response (otherwise, you would record only the first few milliseconds!). Larger negative values will cause DirectRT to wait longer after the initial sound before continuing.

See also: MinMax 45 Values (which apply as usual just like any other RT) for details on how to set additional limits for the RT, clearing the stimulus before or after the RT and so on.

### Advanced Hint

Note that you can specify valid keycodes prior to the audio functions to allow a keypress to be stored with the audio data. This is especially useful if an experimenter wants to code responses via the keyboard after each of the participant's vocal responses. For example:

```
rt:any,aud,rec,-1500,clear-1
```

will take an audio RT, clear the stimulus from the screen at the RT, record the response for 1500ms beyond the RT and will allow any keypress to be coded during that time.

```
rt:any,aud,rec,2000,clear500
```

This above example will take an audio RT, clear the stimulus 500ms after onset, record the response for a fixed interval of 2000ms and will allow any keypress to be coded during that time.

## 8.19 TTL Signals

### Location:

...\DirectRT\samples\5- other features\13 ttl signals

### Sample Description

In order to communicate with external equipment (e.g., physiological equipment, response boxes, other computers), you can send and receive TTL (Transistor-Transistor Logic) signals through any of your computer's accessible ports (e.g., parallel or serial ports). In English, this means you can ask DirectRT to send a value from 0-255 to your external equipment any time you like, and/or you can have DirectRT wait for any value from 0-255 to come from the external equipment. To accomplish sending a value, you list a TTL signal just like any other stimulus in the Stim[19] column of your input file. To receive a value, you list a TTL signal just like any other RT in the Time[30] column. Consequently, you can synchronize the TTL signals with other stimuli in your experiment and use TTL signals as way to record precise RTs from external equipment.

In jargonese, a TTL signal is an 8-bit value (e.g., 00101001) represented in decimal form as a value from 0-5. You should check the documentation that came with your external equipment to see what values it can send and receive. Since 8-bit values can be represented either as their individual bit values (e.g., 00101001) or as their decimal equivalent (e.g., 41), you may need to convert between them (since they're simpler to comprehend, DirectRT uses decimal values exclusively). You can use the Windows calculator program to do this quite easily. Type "calc" from the Run command on the Start menu. From the view menu, click "Scientific." To convert from Binary to Decimal, click "Bin" and type in the bit value (e.g., 00101001) and then click "Dec". You will see the decimal equivalent appear (e.g., 41). To convert from Decimal to Binary, click "Dec" and type in the decimal value (e.g., 41) and then click "Bin". You will see the binary equivalent appear (e.g., 00101001). For future reference you can also use this method to convert to and from Hexadecimal format as well.

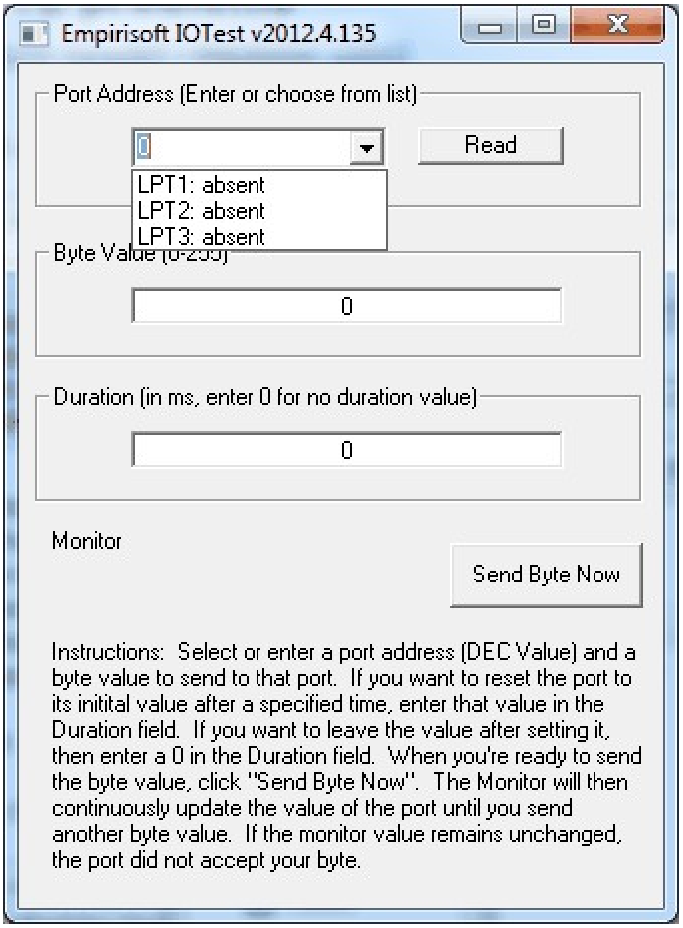
### Ports

So far, we know that DirectRT can exchange values from 0-255 with your external equipment. The second thing we need to know is where that exchange will take place. This meeting place is going to be a "port" located on the same computer as DirectRT. A port is a place where values can be written and read. Ports that are accessible to outside equipment include the serial and parallel ports. You will need to know which port your external equipment connects to and the port address. With this information, you will be set to go. For example, you will be able to tell DirectRT to "send the value 155 to port 330" or "go to port 330 and wait for the values 155, 156, or 157." DirectRT 2018 and 2020 can use port address decimal values ranging from 0 to 65535.

### Initial Testing with your External Equipment

DirectRT comes will a tool called IOTest located in the DirectRT\Utilities/TTL folder. This program uses the same code as DirectRT to send and receive byte values from specified ports, but is simpler to work with during initial testing. If you can get your external equipment to work properly with IOTest, then it should work well with DirectRT. Try running IOTest and follow these directions:

When IOTest starts, you will see a pull down list of ports-these will include port addresses that IOTest immediately recognizes as being available for read/write access. You can choose one of these, or you can enter a port address of your choosing. Some ports (esp. serial ports) may not show up automatically and will have to be entered manually—(see technical note below, COM1 is often 1016). Note that IOTest as well as DirectRT will expect a port address in Decimal form. Since ports addresses are often referred to in Hexadecimal format, you may need to convert a hexadecimal address to decimal. You can use the Windows program calc.exe to do this (see above). Contact us if you have trouble identifying your port.


Empirisoft IOTest v2012.4.135
Port Address (Enter or choose from list)
0
Read
LPT1: absent
LPT2: absent
LPT3: absent
Byte Value (0-255)
0
Duration (in ms, enter 0 for no duration value)
0
Monitor
Send Byte Now

Instructions: Select or enter a port address (DEC Value) and a byte value to send to that port. If you want to reset the port to its initital value after a specified time, enter that value in the Duration field. If you want to leave the value after setting it, then enter a 0 in the Duration field. When you're ready to send the byte value, click "Send Byte Now". The Monitor will then continuously update the value of the port until you send another byte value. If the monitor value remains unchanged, the port did not accept your byte.

After selecting a port address, click the "Read" button next to it. Below where it says "Monitor" you can watch the value of this port. For example, if you select port 888 (often the address for parallel port LPT1) or 1016 (often the value for the COM1 serial port), you can see its current value. If the value at this port address changes, you will see it change here. You can test to see if your external equipment can send values to this port address. Try it and see. If successful, you will see the value change to whatever value you send from your external equipment.

You can also test to see if DirectRT can send values to your external equipment. In the text box where it says "Byte Value (0-255)" try entering a value, and then click the "Send Byte Now" button. If the port is willing and able to accept data then you should see the value update on the monitor, and you should see your external equipment react accordingly if it is able to read the data from that port address successfully. You can also send a byte value for a specified number of milliseconds by entering a value in the "Duration" field. Try entering a new byte value (e.g., 123) and a value of 100 in the Duration field. Then click "Send Byte Now." You should see the monitor briefly display the new value and then return to its original value.

That's it. If the testing was successful, then you should be able to proceed with the samples.

### Send a TTL Signal Via Parallel Ports

Take a look at the sample input file "sendTTL.csv" in this folder for an illustration. In the Stim column, enter "ttl:x" where x is any value from 0 to 255. in the Loc column enter the decimal value of the port you want it sent to such as 888 for lpt1 on most systems, and then in the time column, enter the number of milliseconds you want the value to be maintained before being reset to its prior value. Just enter "0" for "Time" if you want the default behavior of a 10ms set then reset to 0.

Sending ttl signals will not hold up the trial--it's a parallel process; if you request that it be sent for 10ms, that doesn't mean the trial in the input file will be held up at all—the onset of the signal will occur in synch with the next stimulus in the trial.

IMPORTANT: A outward bound TTL signal must be followed by another stimulus—it can be any but the last stimulus on a trial.

### Receive a TTL Signal Via Parallel Ports

Take a look at the sample input file "receiveTTL.csv" in this folder for an illustration. To *read* signals, just specify the rt in the time column as always with one addition: place the port you want to read the signals from in parentheses after the list of valid ttl codes, e.g., if you want to allow 4, 5, and 11 as valid signals from port 889, then enter the following in your time column with no spaces:

rt:4,5,11,(889)

As with keystrokes, the first code listed will be treated as the correct response. For convenience, the TTL codes can also be activated by hitting the corresponding keys on the keyboard (in case your external hardware is not connected)--e.g., if ttl signal "44" is a valid response, you could also hit the "Z" key.

IMPORTANT: As in the sample, you need to SEND one TTL signal somewhere (anywhere) in order for receiving to work. One outward signal initializes everything that all subsequent inward and outward signals need. Note also that the sample input file "receiveTTL.csv" uses port 889 rather than 888 for the parallel port--this is a common port address for incoming data through the parallel port.

Note that multiple TTL signals may be sent and received within a single trial.

### Send or Receive a TTL Signal Via Serial Ports

The 2018 versions DirectRT can send and receive data through via a serial port. To do so you just need to create a file called *comport.txt* in your experiment folder and copy the following text into it:

```
comPort, baudRate, parity, dataBit, stopBit
1,19200,n,8,1
input code (1-255), response value (1-12)
1,1
2,2
3,3
4,4
5,5
6,6
```

You should not modify the first or third line. The second line represents the values of the variables listed on the first line. You can change any of these as necessary. Be sure that the first number of the second row is the same as the comport you want the computer to use to send the ttl signal. In this example, the 1 as the first value in the second row tells DirectRT to use the port labeled as port 1 on your computer.

The remaining lines tell DirectRT how to map incoming signals to response keys. You should use as many lines as different signal values you wish to use. On each line you can list a pair where the first value is the signal sent to the serial port (i.e., 1-255) and the second value is the response it should map on to (i.e., 1 to 12). In the example above, if DirectRT detects a "1" coming through the serial port, it will react as though the 1 key was pressed; the same is true of responses and key mapping values 2 through 6. To see what values to use as the second number in these lines, see the key codes for DirectRT 93.

You will still set up the .csv input file to send 90 or receive 90 ttl signals as if using a parallel port; DirectRT still needs to see the ttl values in .csv file folder. As long as there is a *comport.txt* file in the same file folder as your .csv input file, DirectRT will ignore the values in the .csv input flie and use the ones in the *comport.txt* file.

### Technical Note

To obtain the decimal address of a port, right click on "My Computer" and select "Properties" and the "Hardware" or "Device Manager". Under "Ports" you should see your various ports listed which should include your standard serial port (e.g., COM1 or COM2 usually). Double click on the port of interest and select "Resources". You'll see an input-output range like "03F8-03FF" or something like that. That's HEX and you need to convert it to decimal. You can do that with the Windows calculator put into scientific mode. Select HEX and enter the value and select DEC and it will be converted. e.g., try entering 03F8 and convert it--you should see the decimal value which is 1016. If that all sounds like total Greek to you then just ask one of your tech people--they'll probably be able to tell you in 2 seconds.

## 8.20 IAT

### Location:

…\DirectRT\samples\5- other features\14 IAT-Practice

…\DirectRT\samples\5- other features\15 IAT-Race

### Sample Description

"I've tried the DirectRT implementation of the IAT. It worked like a charm and has an appearance very similar to the lab procedures we've been using for the last few years."

> -Anthony Greenwald
> Co-Creator of the IAT
> University of Washington

These samples were designed as a template for conducting IAT sessions with a variety of stimuli. Since the typical design of an IAT is rather complex, you can use this sample as a reference when building your own IAT, or you can simply copy it and substitute your own stimuli and scales—and voila! A nearly instant IAT!

If you're new to DirectRT I suggest you run through the tutorials before attempting to follow the IAT input file (this is kind of advanced stuff).

Some things to notice:

The "IAT-Practice.csv" sample input file in the "14 IAT-Practice" file folder contains 5 blocks of trials. In this sample, we are only interested in data from blocks 3 and 5—consequently, we use a block ID of 0 for the other blocks so that they will not be written to the data file. We also use an optional comment column (!Step) to identify which block (or Step) the trials belong to.

The bgr[17] column contains all 0's because the order of the blocks is not randomized. The wgr[17] column contains identical values for all items within blocks 1, 2 and 4 so that the items within each of those blocks will be randomized. In blocks 3 and 5 alternating patterns of wgr values allow us to alternate between randomly ordered adjectives and targets. Note that the instruction screens always have a wgr value of 0 so that they will stay where they are.

In the time[30] column, some trials specify "rt:23,18" and others specify "rt:18,23". This tells DirectRT which response is correct since the correct response is always listed first.

Now take a look at the "15 IAT-Race" folder. In this sample, we have

Adjective1 = Good, Adjective2 = Bad

Target1 = White, Target2 = Black

These could be switched with whatever you like.

The first Stim column contains the scale that should appear on screen. On the first trial, the scale is "a2-a1." Take a look at the image file in the stim folder called "a2-a1.bmp." It's a label that reads "bad - good". That's because a2-a1 means adjective2 (bad) on the left and adjective1 (good) on the right.

Later the scales get more complicated because you have to have an adjective and a target on each side. E.g., look at "a2t1-a1t2.bmp." You'll see adjective2 (bad) and target1 (white) on the left and adjective1 (good) and target2 (black) on the right.

Do you see how this could act as a template? You wouldn't have to change the input file—just the stimuli. If your targets were "me" and "other", instead of "white" and "black", you could just replace "white" with "me" and "black" with "other" on each of the scale graphics.

The same goes for the second stim column. In the column you see that a random stimulus is drawn from the text files "adjective1.txt", "adjective2.txt", "target1.txt" and "target2.txt". Take a look at the adjective1.txt file. Since adjective1 = "good," the stimuli in this stim list are words like "JOY", "LOVE" and "PEACE." You could simply replace these words with ones representative of whatever you're using as adjective1.

A couple final notes, you may want to shorten the trial interval[49] in this experiment to make the "flashing" between trials less pronounced. To do this, click on "Options[47]" in the style file, IAT.drt. Remember though that DirectRT prepares the next trial during the trial interval, so be sure to give it at least 50-100ms.

The scales in this study were made with a graphics programs called Fireworks by Macromedia. It's a great program for putting together formatted text and saving it as .bmp graphics that you can use in DirectRT. A free trial version is available from https://creative.adobe.com/products/fireworks. If you get it, you can modify the source files used for this sample that are located in the Fireworks subfolder.

## 8.21 Ch'IAT Children's IAT

### Location:

...\DirectRT\samples\6- v2006\ch-iat (zipped)

### Sample Description

Similar to the regular IAT 91, the ch-IAT was designed specifically for children. This particular implementation was constructed for DirectRT by Jamie Barden at Howard University and Barry Corenblum at Brandon University in Canada.

## 8.22 Advanced Graphics

### Location:

...\DirectRT\samples\5- other features\15 advanced graphics

### Sample Description

For the truly masochistic and/or the individual who feels that DirectRT is just too darn easy, here is a sample that will surely challenge you. Put together with Geoffrey Cohen and Mitch Prinstein at Yale, this study simulates a group interaction study over the web. Uses just about every graphics trick that DirectRT has to offer. Too much to explain here. If you see something you like and can't figure it out, feel free to email me and I'll be happy to elaborate. –Blair

Note: In your display settings, you should select "advanced" and then "large fonts" in order for this sample to look exactly as it should.

# 9 Key Codes and Notes

## 9.1 Key Codes

In addition to the specific key codes, other allowable keypress events are:

- **any** = any key
- **num** = any number key on the regular keyboard
- **numpad** = any number on the number pad
- **alpha** = any character of the 26-character alphabet
- **funct** = any function key

### Common Key Codes

| Key | *Code* | Key | *Code* | Key | *Code* | Key | *Code* | Key | *Code* | Key | *Code* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | *1* | P | *7* | F | *59* | A | *3* | N | *4* | E | *2* |

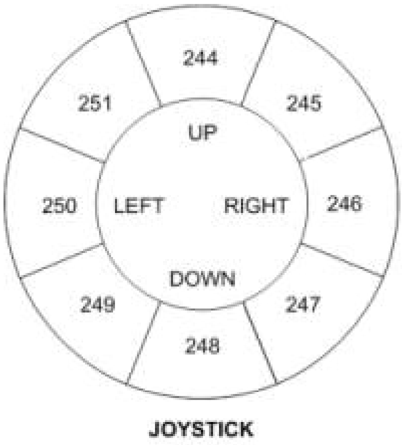
| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ad1 | 9 | 1 | | | 0 | | 9 | nter | 8 |
| 2 | 2 | Pad2 | 80 | F2 | 60 | B | 48 | O | 24 | Space | 57 |
| 3 | 3 | Pad3 | 81 | F3 | 61 | C | 46 | P | 25 | lShift | 42 |
| 4 | 4 | Pad4 | 75 | F4 | 62 | D | 32 | Q | 16 | lCtrl | 29 |
| 5 | 5 | Pad5 | 76 | F5 | 63 | E | 18 | R | 19 | lAlt | 56 |
| 6 | 6 | Pad6 | 77 | F6 | 64 | F | 33 | S | 31 | rShift | 54 |
| 7 | 7 | Pad7 | 71 | F7 | 65 | G | 34 | T | 20 | rCtrl | 157 |
| 8 | 8 | Pad8 | 72 | F8 | 66 | H | 35 | U | 22 | rAlt | 184 |
| 9 | 9 | Pad9 | 73 | F9 | 67 | I | 23 | V | 47 | ; | 39 |
| 0 | 10 | Pad0 | 82 | F10 | 68 | J | 36 | W | 17 | ' | 40 |
| | | | | F11 | 87 | K | 37 | X | 45 | , | 51 |
| | | | | F12 | 88 | L | 38 | Y | 21 | . | 52 |

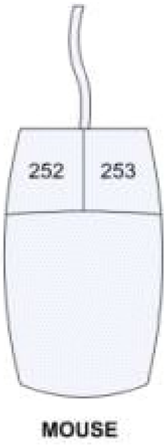
| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | M | 50 | Z | 44 | / | 53 |

### Less Popular But Still Loved

| Key | Code | Key | Code | Key | Code |
|---|---|---|---|---|---|
| - | 12 | Home | 199 | PgDn | 209 |
| [ | 26 | Insert | 210 | PgUp | 201 |
| ] | 27 | Left | 203 | Right | 205 |
| ` | 41 | LWin | 219 | rWin | 220 |
| = | 13 | NumLock | 69 | ScrollLock | 70 |
| Apps | 221 | PadCom | 91 | SysRq | 183 |
| Backspace | 14 | PadDec | 83 | Tab | 15 |
| CapsLock | 58 | PadDivide | 181 | Up | 200 |
| Delete | 211 | PadEnter | 156 | | |
| Down | 208 | PadMinus | 74 | | |
| End | 207 | PadMult | 55 | | |
| Esc | --- | Pause | 116 | | |

### Joystick & Mouse Codes





| Joystick | *Code* | Mouse | *Code* |
|---|---|---|---|
| Button 1 | *241* | Left-Click | *252* |
| Button 2 | *242* | Right-Click | *253* |
| Button 3 | *243* | Mid-Click | *254* |
| Up | *244* | Other-Click | *255* |
| Up-Right | *245* | | |
| Right | *246* | | |
| Down-Right | *247* | | |
| Down | *248* | | |
| Down-Left | *249* | | |
| Left | *250* | | |
| Up-Left | *251* | | |

Note about joystick codes: You must first make sure your joystick is set up to work with Windows programs. You can set up your joystick by selecting "Gaming Options" or "Joystick" in the Windows Control Panel. You might need to "add" your joystick if you do not see it currently configured there. When you check this, it's also a good idea to calibrate your joystick using the calibration utility provided by Windows. The movement codes above (i.e., 244-251) are triggered as follows: DirectRT divides the joystick range into 8, 45 degree angles (like cutting a pizza into 8 slices). As soon as the joystick has moved more than half of it's range in any direction, DirectRT determines which of the 8 "slices" the joystick is in and takes that as the response and records the RT at that point. See also: Continuous Joystick Capture 73.

Note about mouse codes: You may choose to have subjects respond with mouse clicks rather than key presses. This can easily be done with the mouse codes above. Note that you will not see the mouse cursor.

### See also

Using Key Codes in the Time 30 Column.

## 9.2 Notes About Image Files

### BMP vs. JPG & GIF

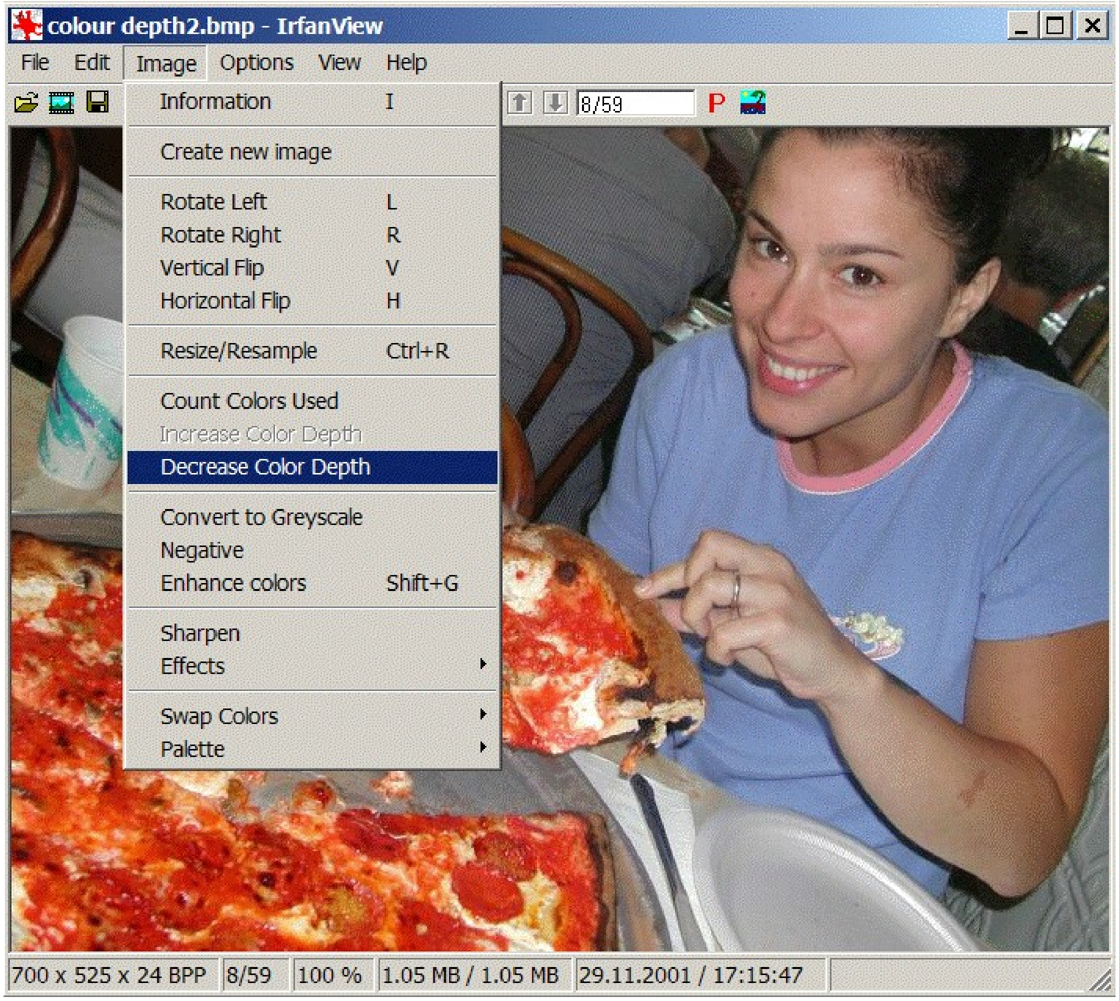
DirectRT uses bitmap (.BMP) images. The reason is that bitmap images are not compressed the way jpeg or gif files are. What's so good about that?! Yes it means bigger files taking up more hard drive space; your pain is felt. The benefit is SPEED. Because bitmap files are not compressed, they do not need to be DE-compressed prior to their display. This hastens things up considerably.

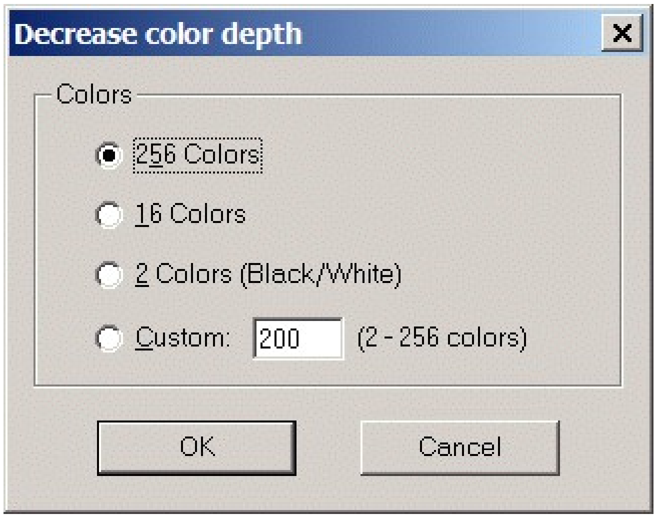
### 8-Bit, 256 Colours vs. 24-Bit, Millions of Colours

You can further ease the processing load on your computers by converting your images to 8-bit (256 color) depth. This will cut your file size down by two thirds! This can be done with little loss of image quality. If you don't have a utility for doing this, there is a freeware program called IrfanView that does a great job. Find it at http://www.irfanview.com/.

With IrfanView, to convert from 24bit to 8bit color (see Figure):

- Open the image, from the Image Menu, select Decrease Color Depth
- Select 256 colors and save your image. Check the difference in file size!





Decrease color depth

Colors

- ● 256 Colors
- ○ 16 Colors
- ○ 2 Colors (Black/White)
- ○ Custom: 200 (2 - 256 colors)

### Using Fireworks

You can always use text and text files for presenting instructions. However, sometimes, you may want more control over formatting. In such cases, you can create instruction screens with your favorite image editor and save the results as a .bmp image file. Many of the samples use instruction screens that were created with a program called Fireworks produced by Macromedia (e.g., Open Ended Responses 69). The text for the instruction screens is easily formatted in Fireworks and then saved as a .bmp image in the experiment's stim folder. Some sample Fireworks source files (.png) are located in the IAT sample's stim folder. Fireworks files can be easily created and edited by downloading the trial version:

https://creative.adobe.com/products/fireworks

Simply open the corresponding .png file in Fireworks and edit the text. To save your changes as an image file, select "Export" and choose to save it in the .bmp image format. Fireworks is a great program for creating high quality text-based images.

### Creating Graphics with PowerPoint

The Priming with Images 69 sample illustrates how you can use PowerPoint to create graphics to use in your DirectRT session. To do this follow these steps:

- Set your system's display settings to match the screen resolution in which you'll be running your DirectRT session (e.g., 640x480, 800x600, 1024x768).
- Run your PowerPoint show *at this resolution*.
- For each screen, when it appears, press PrintScreen. Press Esc to stop the show and minimize PowerPoint.
- Open your graphics application and select Paste. The screen image will be pasted into your graphics application as a graphic.
- Save the image as a .bmp file. Remember that DirectRT can process the image much faster if you save it in 8-bit or 256 colors.

### From Other Windows

You can also capture the contents of any open window as a graphic by pressing Alt-

PrintScreen. By pressing Alt when you hit PrintScreen, you limit the graphic to the currently active window. Hitting PrintScreen alone capture the entire screen. Then, open your graphics application and Paste the image and edit it as necessary.

### Creating scales

Creating scale images with ticks and equal distances between the ticks can be tricky in standard graphics applications. The scale image used in the Assessing Modern Racism 69 sample was done as follows:

- Start Excel or another spreadsheet application.
- Select all the cells and choose a color fill (e.g., black).
- Select all the cells and select a fairly thick color border (e.g., yellow).
- Select a common column width according to how far apart your scale points should be graphically.
- Use the Alt-PrintScreen method described above to capture the window as a graphic.
- Paste the image into any graphics editor and trim the excess away leaving your scale and tick marks.
- Add text labels as desired and save.