

Cyberball: A program for use in research on interpersonal ostracism and acceptance

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Since the mid-1990s, research on interpersonal acceptance and exclusion has proliferated, and several paradigms have evolved that vary in their efficiency, context specificity, and strength. This article describes one such paradigm, Cyberball, which is an ostensibly online ball-tossing game that participants believe they are playing with two or three others. In fact, the "others" are controlled by the programmer. The course and speed of the game, the frequency of inclusion, player information, and iconic representation are all options the researcher can regulate. The game was designed to manipulate independent variables (e.g., ostracism) but can also be used as a dependent measure of prejudice and discrimination. The game works on both PC and Macintosh (OS X) platforms and is freely available.

In 1983, the first author was relaxing at a park with his dog, Michelob, when a Frisbee rolled up and hit him in the back (the first author, not the dog). He turned around, saw two other guys looking at him expectantly, and threw the Frisbee back to them. He was a bit surprised when they threw the disk back to him; he walked toward them to form a triangle, and threw it back again. For about a minute, the three of them threw the Frisbee around in a spirited game of catch. What happened next sparked an idea as to how to study the effects of ostracism. For no apparent reason, the two original players started throwing the Frisbee only to each other, and never threw it to the newcomer again. After sheepishly backstepping toward his dog, the first author was amazed at how bad he felt. He was sad, embarrassed, and a bit angry. He wondered what he had done to warrant being ostracized by the other two players. He sought comfort from his faithful dog. Then, it occurred to him that something like this, adapted for the laboratory, would be an excellent means to study ostracism and social exclusion.

The first laboratory incarnation was a face-to-face ball-tossing paradigm (Williams & Sommer, 1997), in which participants began tossing a ball around while they were waiting for the experimenter to return. Half the participants were included so that they were thrown the ball one third of the tosses, while half received the ball only a few times, then never again for the 5-min duration. This had surprisingly strong effects on participants. The ostracized participants showed marked nonverbal affectations of distress. In a subsequent work task, females (but not males) who had been ostracized worked significantly harder when working collectively with the others, a sign the authors interpreted as the participants' attempts to get back into the good graces of the group. This face-to-face task has been used a few times (Warburton, Williams, & Cairns, 2006; Williams, 2001), but as powerful as it is, it is cumbersome and inefficient. Confederates are required, training is necessary, and the task of ignoring and excluding is an arduous one that confederates approach first with concern and sympathy, but later, seemingly, with sadistic glee.

We thank the Australian Research Council for grants awarded to the first author that allowed us to develop and continually update versions of Cyberball. We thank Matt Mashyna for his programming skills in designing the applet versions of CyberballPC and CyberballMac. We thank Christopher Cheung and Wilma Choi for their original versions of the virtual disk-tossing game and of Cyberball, and Keith Lim for the initial on-computer (rather than online) versions. We also thank Cassie Govan, Trevor Case, and Lisa Zadro for their insightful comments and advice. For conceptual issues related to Cyberball's use in research on ostracism or other social psychological phenomena, contact K. D. Williams, Department of Psychological Sciences, Purdue University, 703 Third Street, West Lafayette, IN 47907 (e-mail: kip@psych.purdue.edu). For questions regarding the actual programming of Cyberball, contact B. Jarvis at Empirisoft Corporation, 28 West 27th Street, Floor 5, New York, NY 10001 (e-mail: jarvis@empirisoft.com).

Basis for Program Creation

This led us to design a new task that captured the essence of the ball-tossing game, but did not require the use or training of confederates. Cyberball (Williams, Cheung, & Choi, 2000) was the result (although we originally feared that it might be too inconsequential or too minimal to have an impact on participants). Participants were recruited to log on to an online experiment, in which they either played a virtual disk-tossing game (Study 1) or a virtual ball-tossing game (Study 2) with two other participants who had ostensibly logged on from somewhere else in the world (in fact, we had over 1,400 participants from over 67 countries). Our cover story (see Figure 1)

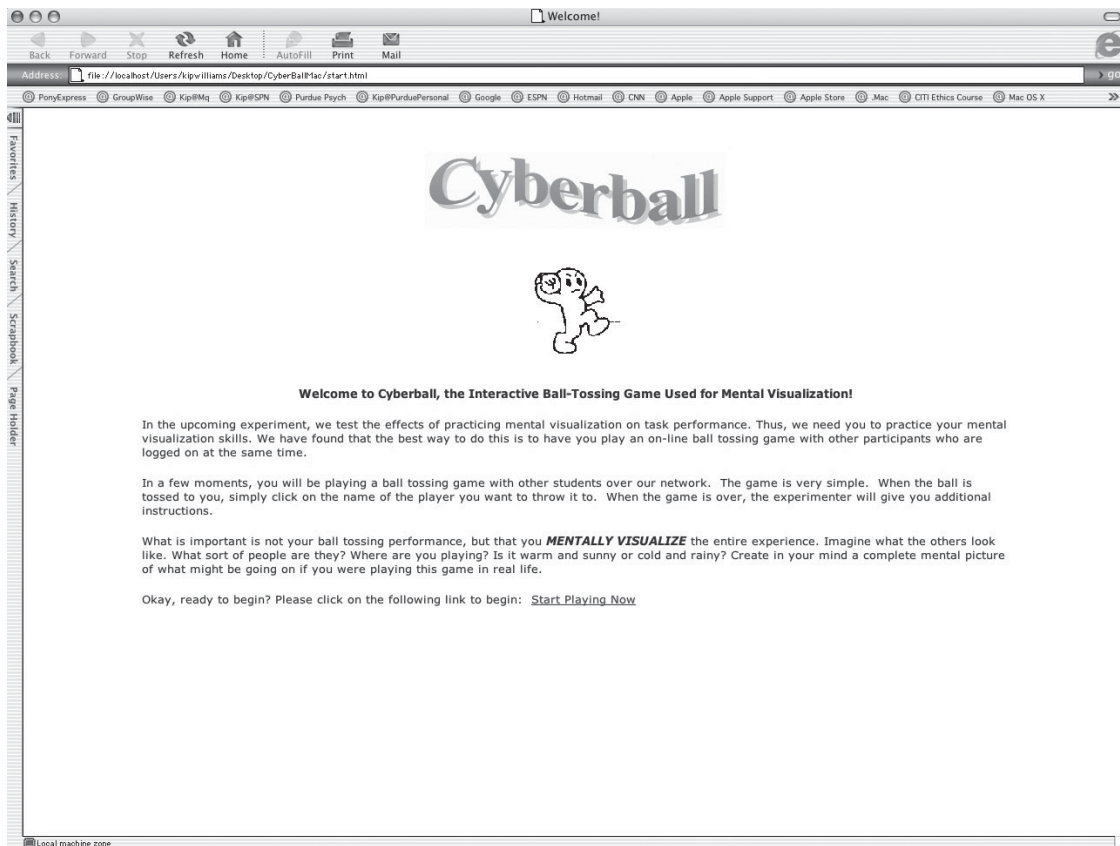


Figure 1. The welcome page and cover story that is presented to experimental participants. It is easily changed within the Cyberball program.

informed participants that Cyberball was a means to an end, and was, by itself, unimportant for the experiment. It was portrayed as merely a task that helped participants exercise their mental visualization skills, which they would purportedly use in the subsequent experimental task. After reading the instructions, they would view a game in which the players were represented on the screen by animated icons (see Figure 2). They would then play Cyberball for about 5 min.

The results astounded us. Although participants were playing a game with a disk or ball that did not actually exist and with fictitious others whom they did not know and whom they did not expect to meet, they actually cared about the extent to which they were included. If they were overincluded (getting the ball for one half the throws) or included (getting the ball for one third of the throws), they felt better than if they received the ball for only one sixth of the throws. Still, getting the ball for a sixth of the time was significantly better than not getting it at all. Fully ostracized participants answered a postexperimental questionnaire indicating lower levels of belonging, self-esteem, control, and meaningful existence. (For the typical postexperimental measures, see Zadro, Williams, & Richardson, 2004.) In Study 2, ostracized participants were subsequently more likely to conform their answers to

those of five other unanimously incorrect (and fictitious) participants on an online perceptual task (Williams et al., 2000).

Our fears that this paradigm would be too minimal were apparently unfounded. In this and subsequent studies, we continue to find strong effects (often with effect sizes ranging from 1.0–2.0) on our postexperimental measures, which ask participants to report how they felt during the game (i.e., mood, and levels of belonging, self-esteem, control, and meaningful existence). In fact, we have needed only 3 participants per condition to reach significance levels below $p = .05$ on these questions. In subsequent studies, we have tried to minimize various aspects of the task even further, so that we can determine the features that are necessary to produce negative impact from ostracism.

In one study, participants were told that they were either playing with other people, or with the computer. This manipulation was clearly perceived, but had no effect on how they felt if they had been ostracized (Zadro et al., 2004). In another study, we convinced participants they were playing with ingroup members (people of a similar political persuasion), rival outgroup members (people of the opposing political persuasion), or despised outgroup members (individuals who belonged to the KKK). Even



Figure 2. Participants see these icons on the computer monitor, on which the ball is seen traveling from player to player. If the participant (represented by the hand icon at the bottom) receives the ball, he or she is required to click on one of the other two players in order to throw the ball to that person. Pictures of players and their names are not necessary for the successful use of the game; this is one option.

when playing with people they openly despise, ostracized participants reported similarly low levels of belonging, self-esteem, control, and meaningful existence, and similarly lower mood levels, as well (Gonsalkorale & Williams, in press). Eisenberger, Lieberman, and Williams (2003) asked participants to play Cyberball inside an MRI chamber in which the blood flow in their brains could be monitored. They reported more distress and showed activation of the anterior cingulate cortex—the same region of the brain that registers physical pain—when they were ostracized during Cyberball, even when they thought that their computer was not yet connected to the computers of the other two players. Finally, we have even tried to make it more costly to be included than to be ostracized, by having the players throw a bomb that would explode at some point and eliminate the player (Cyberbomb), or by deducting money from players to whom the ball was thrown (Eyberball), and still, being ostracized was psychologically distressing (van Beest & Williams, 2004, in press).

So, despite our attempts to create contexts for which Cyberball ought not be meaningful or distressing, we continue to find that it is, at least when we examine participants during or soon after the experience.

From Online to On-Computer

Although the game was originally designed as an actual online experiment, various factors led us to make the game appear as though it were online, although it is actually fully contained within the laboratory computer. First, the paradigm involves deception, and ethical concerns arise about the effectiveness of online debriefing. Second, we were experiencing problems with viruses and downloading onto our server that rendered the online paradigm unattractive to our computer technicians.

We therefore developed Cyberball to appear as though it were running within a browser and as if other players were also logged on and playing, but in fact, the program (and stored data) were contained fully on each computer on which it was used, thus ensuring face-to-face debriefing and computer protection. This version was then outsourced to the second author, who made visual improvements to the game and implemented several options that would allow researchers to tailor it for their purposes.

Program options. The user can set the following options: (1) how many other players there are (two or three), (2) who throws the ball to whom, and when, (3) the speed of the game (i.e., how fast the ball is thrown), (4) the length of the game (i.e., the total number of throws),

(5) the labels for players (i.e., text), and (6) pictures or iconic representations of the players. The animations can also be replaced with any animations the user wants to self-generate.

There are six folders in Cyberball, and any content in any folder can be modified. There is a “3-player” folder that contains .gif files of three-player animations, and a “4-player” folder with .gifs for animation of the four-player game. There is a “Faces” folder, in which any thumbnail pictures can be stored. There is a “Schedules” folder containing standard or specialized schedules. For example, the program includes “all include 3,” in which all three players are equally included, “ostracize subject 4,” in which only the participant is ostracized, while the other three play with each other, and “change of heart,” in which the participant is ostracized at the beginning of the game, but then at some predetermined point, the other players include the participant. The number and types of schedules are limited only by the researcher’s imagination. There is a “Settings” folder that contains text files that describe the number of players, the total number of throws, the schedule, the names of players, the game speed, and the spacing.

Data (who threw the ball to whom, including the choices made by the participants and confederates) are kept in the “Logs” folder. These data are easily pasted into Excel or SPSS files for analysis.

There is also a reader-friendly read-me file, a start page that allows experimenters to use the preexisting cover story (i.e., mental visualization) or to write their own, and a thank you page for explanations and debriefing.

Accessibility

We decided to make this version freely available to researchers (downloadable through the first author’s Web site: www2.psych.purdue.edu/faculty/~kip). Initially, this version could be used only on PCs, but recently, with additional outsourcing, we have completed the present version, which can be used on both PC and Mac (OS X) platforms. Cyberball also works seamlessly with MediaLab (Jarvis, 2004), making it easy to insert between other manipulations and measures. The read-me file explains all the options and gives examples so that users can quickly begin using and configuring Cyberball for their purposes (see the Appendix).

Independent or Dependent Variable

Cyberball was originally intended as a manipulation of ostracism—being ignored and excluded—for a program of research by the first author (see Williams, 1997, 2001; Williams, Forgas, & von Hippel, 2005; Williams & Zadro, 2005, for reviews of this research program). Researchers from around the world have used it for similar purposes, sometimes with minor modifications (see Cyberbomb, van Beest & Williams, 2004; and with output features for physiological research), but always for the purpose of manipulating inclusion and exclusion (or rejection).

Cyberball could also be used as a dependent measure of prejudice and discrimination, empathy, and altruism. Experimenters can observe whether and how often participants throw the ball to the other players. The other players

could be people who possess negative or positive characteristics. Thus, the participants’ choices to include or exclude (and to what extent) could be precisely measured. For example, imagine a situation in which there are three other players in addition to the participant. One player is clearly stigmatized through their label or picture. The other two players do not throw to this individual, leaving the participant to struggle with a social dilemma: Should he or she (1) compensate for the other players’ ostracism by including (perhaps overincluding) the stigmatized player, or (2) perhaps to avoid being ostracized, should he or she *go along with the crowd* and also ostracize the stigmatized player?

Conclusions

Cyberball is a freely downloadable program that can be used on PCs and Macs by researchers interested in any aspect of social acceptance or exclusion. It portrays a relatively decontextualized social situation into which can be added all sorts of context, either through variations in the cover story, through information provided about the other players, or through what information is ostensibly given to the other players about the participant. We encourage others to find new uses for Cyberball and hope this article will expose a wide variety of researchers to its possibilities.

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APPENDIX

Cyberball, Version 3.0

Overview

Cyberball (Version 3.0, released October 4, 2004) is a program that allows you to create various interactive scenarios using a simple ball-tossing game. In this game, the real participant plays ball with two or three other players who are thought to be real and connected through a network. These other players are, of course, computerized confederates. Using schedule files, you can define the behaviors of these confederates. You can tell each confederate to include or exclude any other player at any time. If you instruct a confederate to exclude another player (real or virtual), you can specify when this happens. Using settings files, you can define how long the game will last, the number and names of players, the pace of the game, and the schedule file you want to use.

Quick Demo

To run the program, double-click the Cyberball icon located in the “Cyberball” folder after installation. You will be prompted for a settings file. Select 4pl - ostracize subject.txt from the “Settings” folder. You will then be prompted for a subject ID. Try entering “1.” Read the instructions that appear and then click the link to begin. When you’re done (this takes about 5 min), your data will appear in the file log.csv in the “Logs” folder.

How It Works

Cyberball uses two types of input files. The first is called a settings file. Look in the “Settings” folder and open the file settings.cb3. This is a settings file, and is depicted below.

You can create as many settings files as you like. The first row defines whether the game will have three or four players (including the real participant). The second row defines how many total throws will occur before the game ends. The third row defines the schedule file (see below) that sets the ostracism behavior of the confederates. The next four rows define the names of the players.

The first player is the leftmost player and the second player is always the real participant. The third player is the rightmost player and the fourth player is the topmost player, who appears only in a four-player game.

After each name, you may specify an optional image file for the player, which will appear during game play. Note that both names and images are optional. If you do not want a name or an image to appear, simply enter “none,” for example, “name1, none, none.” The next row defines the pace of the game. There are two values here. The first value is a constant number of seconds to add between tosses. The second value is the upper range of a random time value to add to each trial. In the case below, each throw will take 2 sec plus a random value between 0 and 3 sec.

Finally, the last row defines how many blank spaces should be provided in the top of the browser window. A smaller number (e.g., 0) may be useful here if small screens are to be used.

```
players, 4
total throws, 30
schedule, ostracize subject.csv
start page, start.htm
name1, Trevor, trevor.jpg
name2, Kip, kip.jpg
name3, Cassie, cassie.jpg
name4, Blair, blair.jpg
game speed, 2, 3
spacing, 2
```

The second type of file is called a schedule file. From the “Schedules” folder, open the file ostracize subject 4.csv. You can open it in any text editor, such as NotePad or WordPad.

```
1,234,34,34,34,34,34,34
3,124,14,14,14,14,14,14
4,123,13,13,13,13,13,13
```

This file contains the ostracism behavior of the various confederate players during the game. In your settings file, you will need to specify a schedule file such as this one. Each row defines the behavior of one player. The first number in each row is the player—remember that Player 2 is always the real subject, so you won’t schedule his or her throws. The remaining numbers in each row indicate who the player is going to throw to each time he or she gets the ball. Numbers grouped together between commas are randomized.

For example, look at the first row. This is how Player 1 (the leftmost player) will treat everybody else. The first three throws will go to Players 2, 3, and 4, in randomized order. After that, Player 1 is apparently going to ostracize Player 2 (our participant) by throwing only to Players 3 and 4—throwing to each of them in a random order once every two throws.

Because Player 2 is the real participant, we do not define a schedule. Of course, the real participant can choose to ostracize any of the confederates during the game, but we do not define acts of free will here—only the acts of the computer.

Players 3 and 4, the rightmost and topmost players, are also going to ostracize the real participant (Player 2) after throwing once to each participant in random order.

APPENDIX (Continued)

Basically, this schedule means that after the real participant has caught the ball once from each of the other players, no one is going to throw to him or her anymore.

Because you can explicitly control each of every confederate’s throws, you can adjust the level of ostracism of any player at any time. To see an example, look at the “change of heart” sample. In this one, one confederate throws only to the real participant after first having joined the other confederates in ostracizing him. By the end, everyone is throwing to the real participant again.

Schedule File Rules

Each confederate player must have enough throws listed to cover total throws/2. For example, if there are to be 30 throws total, each confederate should have 15 throws defined.

A schedule for a three-player game must define throws only for Player 1 and Player 3.

A schedule for a four-player game must also define throws for Player 4.

In a three-player game, throws can go only to Players 1, 2, and 3.

In a four-player game, throws can also go to Player 4.

Confederates cannot throw to themselves.

Data Collection

The Cyberball program records all tosses that occur during the game. These data, along with the subject ID, date and time of the session, and other information about the session, are appended to a file called log.csv, which will be located in the “Logs” folder.

A separate but structurally identical data file will also store the time of each throw rather than the target player. These times will be appended to a file called time.csv, which will also be located in the “Logs” folder. *Data are written when the browser is closed after the game.*

Instructions for Participants

Instructions can be modified by editing the file start.htm, located in the “HTML” folder. This can be done in any HTML editor, such as FrontPage or Microsoft Word. Multiple instruction pages can be developed for different conditions. You can specify an alternate starting file in the settings file. You can also edit the thankyou.htm file that is displayed at the end of the game, as well as the connecting.htm file.

Using Keypresses Rather Than Mouse Clicks

Note that the participant may use keypresses rather than mouse clicks to throw. So that it will make sense to the participant, the key mappings are different in three- as opposed to four-player games. This is only to help the participant, and does not affect the data recorded. If you look at the column below labeled “Data File,” this tells you the actual position thrown to.

3-Player Keys		4-Player Keys			Data File	
“1”	“2”	“1”	“2”	“3”	1	3
S		S			2	

Running Cyberball From MediaLab (PCs Only)

Optionally, you can run Cyberball from within a MediaLab session so that subject IDs and setting files can be entered automatically. To do this, follow these steps:

Create a text file in the main “Cyberball” folder called medialab.txt. This file should contain the path to MediaLab on your computer, for example, C:\MediaLab or C:\Program Files\MediaLab. When you add this file, Cyberball will know where to get the current subject ID of the participant so you will not have to enter it manually when Cyberball starts.

In your MediaLab questionnaire, choose an “Executable” item type and enter the location of CyberBall2.exe on your computer in the File field, for example, C:\Program Files\CyberBall2\CyberBall2.exe.

In the Parameters field, enter the letter “c,” followed by the name of the settings file you want to use, for example, csettings.txt, to run settings.txt. When you add this command line parameter, Cyberball will know which settings file to use so you will not have to enter it manually when Cyberball starts.

For details about MediaLab, see www.empirisoft.com/medialab.aspx.

Notes About .csv Files

The data files created by this program are saved in the .csv format. This standard comma-delimited format allows editing of input and output files using your favorite spreadsheet application. Excel and some other programs may give you a message saying that saving in the .csv format will cause a loss of formatting and/or other information. This is okay and will in no way harm your data file. Users in a few countries may need to set their “Regional Settings” in the Windows Control Panel to the United States in order to correctly view and edit .csv files in Excel.

APPENDIX (Continued)

When you double-click on a .csv output file, your computer launches the application set by default to open .csv files on your computer. If no default is set, you may have to indicate which application you want to use when you first try this. Just choose whichever spreadsheet program you like to use. If the default program is set, but you want to change it, go to Windows Explorer and find a file of the .csv type. Then follow the appropriate directions below.

In Windows 95/98

Click the file once to highlight it. While holding down the SHIFT key, click the right mouse button on the file and select Open With. Find and select the desired spreadsheet application. Check the box that says "Always Use This Application."

In Windows 2000/XP

Click the file once to highlight it. Click the right mouse button on the file and select Open With. Then choose Find and select your desired spreadsheet application. DirectRT will now send your files to that application for viewing and editing.

Advanced: Syncing Cyberball With External Equipment and Programs Using TTL Signals

This requires the older Version 2 and is for the PC only. TTL is not yet available for Java.

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