MindBall Evaluation

For the Museum of Science and Industry, Chicago, IL
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MindBall in a Nutshell

MindBall is an interactive game where two players compete to move a ball to their opponents 'goal'. The game takes place on a special table, and each player wears a headband with electrodes touching their foreheads. The ball is held on a track and moved by a magnet mechanism under the table. The headbands measure both players' alpha and theta waves, and the table moves the ball toward whoever has lower amplitude waves. A computer monitor sits next to the table and displays each player's levels of brain activity.

The result of this setup is that the ball rolls toward whoever has less alpha and theta wave producing brain activity – whoever is more "relaxed". It is a game of competitive relaxation.

The MindBall apparatus was purchased ready-made by MSI with the intent of testing it and producing a variation in-house to be part of the brain section of the Body Human exhibit.

Evaluation Goals

As the game had already been built, and was just sitting in a room at MSI, the goal of the evaluation was not formative, but rather to determine the level of facilitation that would be required, and to record and report any problems which arose during the evaluation. It was to be observational, with some interviews.

Three possible modes of presentation were being considered:
1) Signage only. No staff present to help or explain.
2) Facilitated but open. A single staff member would be present to explain how to use the game and answer questions. This would limit MindBall to being a demo.
3) Fully controlled. Games would be played for crowds, either by selected volunteers from the crowd or by staff. Other staff would explain what was happening and take questions.

The first of these three modes was considered vastly preferable, and we were asked to test if it were possible.

Evaluation Process

The plan for performing the evaluation was to take MindBall out on the floor of MSI, and test each of the 3 presentation modes on 3 afternoons. We began with signage prepared by MSI, and after a single afternoon session of testing with signage only, it was clear that it would work well without facilitation. The second session, we produced alternate

signage, and concluded that the 1st mode (the most preferable) worked so well that there was no need for staff facilitation, or a 3rd testing session.

During each of the sessions, the table was taken out on the floor and prepared for use, and signage was attached or arranged around it. People were asked if they would like to try a new exhibit which was being tested, and the evaluators stood back and observed. When asked questions, the users were encouraged to read the signage. If asked pointed questions again, answers were given and the problem noted. A successful experience was viewed as participation in which the participants were able to correctly use the equipment and understand the principles behind the game to some degree.

It is worth noting that very different groups of users were encountered during the two visits. The first consisted mostly of school-age (10-14 year old) children on class trips, while the second was largely adults (30-50 year olds).

Results & Discussion

Usage Problems in Session 1
During the first session, with the pre-made signage, many people had difficulty understanding the game. Questions were common, but quite strictly limited to the procedure, goal, and results. Three typical questions were:
1) "Which way does the headband go on?"
2) "Wait. What am I trying to do?"
3) "So… who wins?"

When such questions arose, the participants had trouble finding the answers in the signage, as they were largely buried in paragraph long text.

Common problems observed during use were confined to 4 specific issues:
1) how to wear the headband
2) how to start the game
3) what to do once started
4) who won

The game was extremely popular once people were using it (more on that below), and crowds quickly gathered. Once a crowd had formed, it gained a sort of collective knowledge on how to use the game. Since every potential user had to first watch others using the game, the above problems disappeared. They were only manifest among people who approached an empty table and tried to use the game without seeing others at it first. Because of this, it was necessary to regularly disperse crowds by claiming the game had to be shut down for work.

Another interesting effect of the crowd's collective knowledge was that it occasionally acquired false knowledge. For example, on two separate occasions, a crowd formed around children who believed you had to put the ball back in the middle of the table manually to restart (in fact, the game automatically moves it back to the middle, and if

the ball is moved by hand, it runs considerable risk of rolling away). Until that crowd was dispersed, every game began with one player picking the ball up and moving it.

All of these problems, we felt, were due to overly verbose signage. The three signs provided included only paragraph text on large boards which were placed on an easel next to the table, and taped above the computer monitor. People resisted reading them unless specifically instructed to, and even then often failed to find the instructions.

From all our experiences during this first session, it was clear that with more focused instructions, the game should be entirely usable with only signage to facilitate.

Updated Signage in Session 2
For the second session, new signs were created to address the issues found during the first. The instructions panel was replaced by one with 3 steps:
1) Put on the headband (metal dots touching your forehead)
2) Press the button to start
3) Try and relax

Followed by something along the lines of "The more relaxed you are, the harder you push the ball. Move the ball to your opponent's end to win!"

This sign was placed directly on the tabletop, where it could not be missed. The other signs were slightly simplified and changed to explain in more detail and provide some other related information, then placed on the easel and behind the table, next to the monitor.

These changes fixed almost all usage problems:
1) Some people had trouble finding the button to start. A large arrow or similar sign could easily be placed on the tabletop to help it stand out more.
2) One group again decided it was necessary to manually move the ball to restart the game. The ball and track will have to be protected by some sort of plastic shield.

Even given these problems, every group was able to operate the game helped by signs alone.

General Observations
During both sessions, the game was hugely popular and successful.

Virtually all ages of visitors were able to use it (the youngest to use it properly was 4, the eldest more than 60), though different ages and groups approached it differently:
- Couples saw it as a game, a chance to joke and have an experience together.
- Young children (<10) generally saw it as a chance to show off how smart they were, always looking to their guardians after the match for approval.
- For teenagers (11-16), it was very much a social interaction – they spent the most time talking, and were less concerned with winning.

- Adults (20-50 years old) tended to see it as an interesting challenge and competition, and were the most interested in the results and how to do better.

The duration of the game varied greatly from one age group to another. Young children and adolescents tended to have very short games (<10-15s), while adults could become very competitive and games could last several minutes, with one couple playing 2 games over 6 minutes long each. This could be a serious problem, both for the players, who became tired or bored, and for the audience, which simply became bored.

Among all groups, the game was first and foremost a social activity. Observers usually discussed the matches as they progressed, and other members of the players' group often cheered on or attempted to sabotage one side or the other. Overall, both users and observers seemed deeply involved, and seemed to greatly enjoy the experience.

After a match, the two users would often become very talkative, discussing the highs and lows of what just happened. This included looking at the on-screen record and pointing out memorable bits of the match. Unfortunately, the screen only retains the last several seconds of data, and even that disappears shortly after the match ends. We are certain people would like to have a record of their results. Printouts would give them both something to talk about while walking around, and a very personalized souvenir.

As mentioned above, the game is a crowd gatherer. It was not uncommon to find 10-20 people circled around it at any given time. Crowd pressure actually forced the table back on a couple of occasions, so everything will certainly have to be well bolted down in the final installation, and construction will have to be extra solid.

One final small issue is that when the game first starts, the ball is slowly dragged back to the middle. Many people interpreted this as one player doing much better than the other, and some became discouraged at the perceived losing so badly so quickly. Something as simple as a flashing "START!" on the screen when it is actually ready to begin (after re-centering the ball) could easily remedy this problem.

General Interview Results

With the updated signage, the vast majority (>90%) of participants claimed to understand what they were doing, and were able to correctly identify the winner of a given match. There was some residual confusion about how to move the ball (focusing on the ball vs. clearing the mind), but for the most part, people understood what they needed to do better to win.

Many people were confused about the computer display. It contains 3 boxes, each containing 2 plots. The left and right boxes each plot a single player's alpha and theta wave amplitudes, while the middle plots some sort of combination score for both players. Some people were confused about the axes of these plots ("Is higher or lower more relaxed?"), while many people didn't understand or like the central combination plot.

After playing the game, people reported surprisingly little increase in interest in brain scanning or the different types of brain waves. Rather, they gained interest in meditation. They weren't particularly concerned with the technology in play, but rather how to perform better at the game.

Conclusion & Recommendations

1) Appropriate signage is a must. Clear, concise instructions should be placed on the table, and the button highlighted somehow.
2) With good signage, no staff facilitation is necessary. People are quite able to understand and interact with MindBall on their own.
3) Additional signage should be placed to the side explaining the technology and science behind the game, and listing possible techniques for winning. (Eg. "Make your opponent laugh. That makes their theta waves skyrocket.")
4) The duration must be limited somehow, though a simple time limit is not desirable – it would simply discourage some people from playing. A possible suggestion which would preserve the competition would be to slowly ramp up the sensitivity, so that after a minute or two, slight variations would move the ball further and further. Eventually, even the closest game would be decided fairly this way, and with an appropriate ramp, gameplay for short games would be preserved.
5) Eliminate the central display on the monitor and add "More Relaxed" and "Less Relaxed" labels to the others.
6) Offer printouts so people can discuss their matches afterwards. Our observations indicate that people playing talk about the experience much more after than during, and this would help facilitate that, as well as provide an excellent souvenir and reminder of MSI.
7) Make it clear when the game actually begins, after the ball is re-centered.
8) Cover the ball & track with a plastic shield so people cannot take/move the ball.

We were told that MSI would be re-developing this exhibit, possibly in a variant form. One option which was mentioned would be to have each player playing with a separate ball, so that it would be a race to move your ball a certain distance. In our opinion, this would be a mistake. The direct head-to-head competition fosters discussion and makes it so that both players are part of the same experience. A race format would allow each player to ignore all balls except their own, essentially making it a time-trial, and removing the ability to discuss each other's successes and failures. From our observations, the direct competition is exactly what makes this game so fun and popular.

This is an excellent exhibit which was well received by and highly enjoyable to a broad spectrum of visitors. With some simple signage and minor changes, it will no doubt be a popular addition to MSI. The only downside appears to be that it doesn't appear to spur interest in the mechanism of the game (brain waves, brain scanning), though this may not be the case in a more appropriate context, surrounded by other brain exhibits.