



INDIAN INSTITUTE OF TECHNOLOGY,
KANPUR

SE367: INTRODUCTION TO COGNITIVE SCIENCE

Modelling and experiments on Cognitive Dissonance

Author:

Abhilash Jindal, Y7009

Chintan Pandya, Y7125

Supervisor:

Dr. Amitabh Mukherjee

November 13, 2010

Contents

1	What is Cognitive Dissonance?	2
2	Experiment performed	3
2.1	Design	3
2.2	Conduction of Experiment	3
2.3	Expected Results	4
3	Computational Model of Dissonance	4
3.1	Conventional Bayesian Model	4
3.2	Bayesian Model for experiment performed	5
3.3	Decision leads to conditional estimation	5
4	Results	6
5	Conclusions	7
6	Experiment Link	7

1 What is Cognitive Dissonance?

Cognitive dissonance is a widely studied concept in Psychology and is defined as an uncomfortable feeling in the mind due to presence of conflicting ideas. It leads to a motivational drive to reduce dissonance by blaming, justifying, denying, etc. This may lead to complete change of beliefs, attitudes, and may become cause to certain actions.

It can be better understood with the help of the following examples

- **The Fox and Grapes** This is the classic example of cognitive dissonance from the famous story of the fox and the grapes. In the story, the fox tries to eat grapes from a tree. But, the grapes are hanging very high on the tree. So, the fox jumps and tries to catch them. After being unsuccessful, he comes into dissonance. As he initially was very excited to eat the grapes, but he could not succeed. So, he bends his beliefs coming to a conclusion that the grapes were indeed sour.

Exactly, this kind of change of belief can be seen when some individual fails in an exam after trying hard for it. Eventually, he comes to the conclusion that the selection in the examination is not that big a deal for him.

- **Buyer's Remorse** Buyer's remorse is the feeling of regret after purchasing a commodity. This generally arises with the purchase of a costly commodity. This may arise due to various factors including suspecting that the salesman fooled them to buy worse product, guilt due to extravagance, etc. This state of cognitive dissonance is eased by the buyer by justifying his action of new purchase.
- **Ben Franklin Effect** The effect is best described by looking at how Franklin won over his political opponent.

"I did not aim at gaining his favour by paying any servile respect to him but, after some time, took this other method. Having heard that he had in his library a certain very scarce and curious book, I wrote a note to him, expressing my desire of perusing that book, and requesting he would do me the favour of lending it to me for a few days. He sent it immediately, and I returned it in about a week with another note, expressing strongly my sense of the favour. When we next met in the House, he spoke to me (which he had never done before), and with great civility; and he ever after manifested a readiness to serve me on all occasions, so that we became great friends, and our friendship continued to his death. This is another instance of the truth of an old maxim I had learned, which says, "He that has once done you a kindness will be more ready to do you another, than he whom you yourself have obliged."

After the opponent had lent the book, the opponent came in the state of cognitive dissonance as Franklin was his opponent. But, he resolved his uneasiness of mind by justifying his action by changing his belief for Franklin.

2 Experiment performed

2.1 Design

A new experiment was designed to test cognition dissonance with the help of Professor N.K.Sharma, HOD, IME Department, IIT Kanpur. In the experiment, all the subjects are randomly divided into two groups - control group and test group. They are all shown two videos and had to subsequently rate them on a scale of 10. Along with the rating, they could fill optional subjective comments.

To build trust, experimenter suggests that the first video is very good. They find the first video good indeed building trust in the experimenter.

Control group members are then asked to rate the second video on their own. On the other hand, test group members are suggested beforehand that the second video is not that good.

The second video shown is actually quite brilliant, but, the members of the second group comes in state of dissonance while rating it. There is a difference between the expectations (given by experimenter) and the outcome.

2.2 Conduction of Experiment

Two interesting videos were selected keeping in mind that no subject would have previously seen them before. The videos used were the following:

1. Sebastian's Voodoo (4 minutes long)
2. Christopher Nolan's Doodlebug (2.5 minutes long)

The control group had a total of 18 subjects and the test group had a total of 15 subjects.

The instruction given to the groups were as follows:-

Hello. This is a 10 minute experiment. Under this experiment, you will be shown 2 videos and you will be subsequently asked to rate them on a scale of 10. You can also include optional subjective comments for each video. The first video that you will now be seeing has been very much liked previously. You may open the link now.

The subject watches the first video.

*Please rate it now. **The second video generally does not get that good rating.** (Only included for the test group and not for the control group). You may open the link now.*

The subject watches the second video.

Please rate the video now.

During the whole experiment, experimenter tries to speak convincingly in a charming manner. This is because the experiment demands that the subject trusts the experimenter to later come in the state of dissonance. As, if the subject do not believe in the experimenter. Then, he will not expect that the second video will not be necessarily bad and hence, may not come in the state of dissonance after watching the video.

The experiment was performed on fourth year IIT Kanpur undergraduate male students. They had previously interacted with the experimenter and knew them well.

2.3 Expected Results

Since the test group were brought into the state of dissonance. Hence, they are expected to change their belief about the outcome of the video aligning with the expectation produced by the experimenter. In other words, they are expected to rate the video poorly compared to the control group. Statistically, the average rating for the test group should be less than the average rating of the control group.

Also the rating done by the control group depends solely on their judgement of the video. But, the test group may have varying levels of dissonance due to different amount of trust in the experimenter. Hence, variation in the ratings of test group is expected to be more compared to control group.

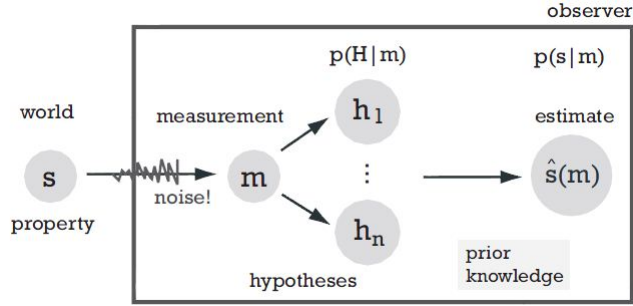
Also, there may be differences in the subjective review and rating for the test group.

3 Computational Model of Dissonance

We adopted the model used in [3]. This method using Bayesian model had been demonstrated to work for the experiment presented in [1]. The experiment belonged to the class of Detection-Estimation experiments showing that detection changes the opinion about estimation. The subject were shown random motion of points and were asked to decide the net direction of the velocity of the points. The models was able to show accurate matching with the human results.

3.1 Conventional Bayesian Model

The following shows the traditional bayesian model used to judge a world state parameter, s , based on the measurement, m and the hypothesis H_1, H_2, \dots, H_n and ofcourse the transitional probabilities.



$$p(H|m) = \frac{p(m|H)p(H)}{p(m)} \quad (1)$$

$$p(s|m) = \sum_{i=1}^n p(s|m, H = h_i)p(H = h_i|m) \quad (2)$$

3.2 Bayesian Model for experiment performed

For our own experiment, the measurements, hypotheses, world parameters are as follows.

Measurement, m	=	Original feeling about the video
World Parameter, s	=	Video Rating
Hypothesis, h_1	=	Expectation that the Video is Good
Hypothesis, h_2	=	Expectation that the Video is Bad
Estimate, \hat{s}	=	Rated Value

3.3 Decision leads to conditional estimation

The authors of the paper [3] change this model in the following manner. In case when observer has already made a decision to select one of the hypothesis as correct, it is assumed that further decisions will be made based on just this single hypothesis rather than averaging over full set of hypothesis. For example, if observer chooses *maximum a posteriori* hypothesis h_{map} , then it causes to alter the posterior probabilities as follows:

$$\begin{aligned} p(H|m) &= 1; && \text{if } H=h_{map} \\ &= 0; && \text{otherwise} \\ p(s|m) &= p(s|m, H=h_{map}) \end{aligned}$$

And the probability $p(H|m)$ is changed by the experimenter by changing the expectations of the subject. In other words, for the control group $p(h_1|m) = p(h_2|m) = 0.5$. But, for the test group, experimenter alter the probabilities for the test group as $p(h_2|m) > p(h_1|m)$.

4 Results

Rating Statistics

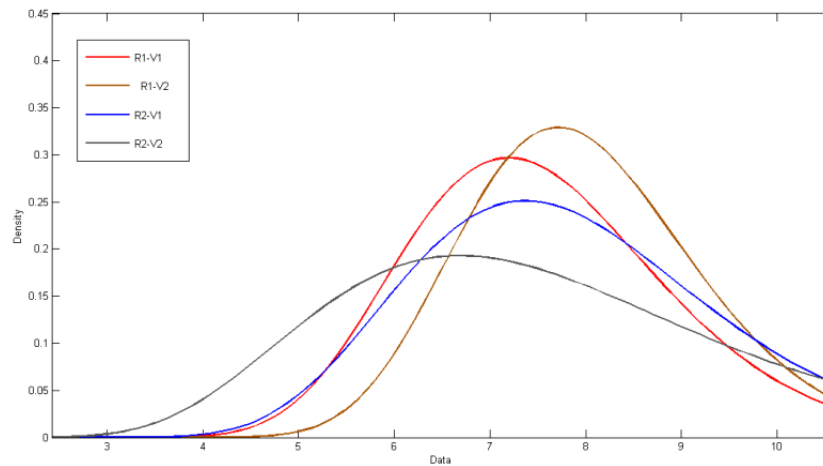
- Actual Rating Statistics

Review #	Video #	Average Rating	Variance
1	1	7.57	1.64
1	2	8.00	1.53
2	1	7.88	2.11
2	2	7.64	3.36

- Gaussian fit Rating

Review #	Video #	Average Rating	Variance
1	1	7.57	1.95
1	2	8.00	1.55
2	1	7.88	2.79
2	2	7.64	5.22

Interestingly we also noted presence of certain patterns in the rating based on the different wings. For example, all the members belonging to one particular wing consistently rated video# 2 much lesser than the video# 1. Whereas, members to the second wing consistently rated video# 2 much higher than video# 1.



- One Sample Review of Video-2 by test group (that rated 8):
It has an awesome abstract feeling about it and till the last moment you keep guessing on what the person is about to and the climax at the end makes you think whoa so this was the thing and it surprises you at the end.

5 Conclusions

We designed an experiment to demonstrate cognitive dissonance. We performed the experiment showing that the results matched the expectations justifying the presence of the dissonance phenomena. In addition to that, a computational model based on bayesian model was looked upon and the parameters were decided.

6 Experiment Link

- Control group:- <http://bit.ly/video-review1>
- Test group:- <http://bit.ly/video-review2>

References

- [1] M. Jazayeri and J.A. Movshon. A new perceptual illusion reveals mechanisms of sensory decoding. *Nature*, 446(7138):912–915, 2007.
- [2] Experiment Resources. Cognitive dissonance. <http://www.experiment-resources.com/cognitive-dissonance-experiment.html>.
- [3] A. Stocker and E. Simoncelli. A Bayesian model of conditioned perception. *Advances in neural information processing systems*, 20:1409–1416, 2008.
- [4] Wikipedia. Cognitive dissonance. http://en.wikipedia.org/wiki/Cognitive_dissonance.