

Perception of Humour
and the
Laughter Track

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Introduction

Laughter is a normal and frequently repeated reaction individuals have to something they think is humorous. Laughter can be triggered by unintended humour, such as a sudden and perhaps clumsy moment, or intended humour such as jokes in movies. However, the intended trigger of laughter can be a more complex phenomenon than one might think. People have different perceptions of what they consider funny, and because of this subjectivity it should be hard to control, but is it? The following report details our experimentation with exposing subjects to different types of humorous stimuli.

The so called “laughter track” was introduced in 1950 in an American sitcom *The Hank McCune Show* and since then comedy programs make use of it to point out moments in a show where the viewers are expected to laugh. This technique comes from early live comedy shows where loud laughter in the audience triggered the infectious continuation of laughter from most of the other spectators. We assume that since the laughter track has been actively used for more than 60 years and is constantly replicated by many popular television shows, the effectiveness of triggering laughter is empirically proven. Participants of our research group can observe the effectiveness of this technique on themselves too, which shows that people are aware of this psychological technique imposed on them and may consciously or unconsciously accept it. Our aim is to explore: How does the laughter track influence brain activity while observing comedic television programs?

Our plan has been to test the brain’s reaction to three kinds of laughter-triggers on a group of people, homogenous in terms of age and educational level, and mixed in terms of nationality and gender. Our three visual materials have involved a short piece of a video comedy, a short piece of video comedy with a laughter track added to it and an audio laughter track, independent of film. Our choice of video comedy has been of a simple nature in order to be internationally understandable, so that language based jokes do not produce a difference in perception by different nationalities. Thus, the preferable kind of comedy chosen was 2 popular sitcoms; *The Big Bang Theory*, and *Friends*. Each piece is roughly 1 minute in length. In order to maximum our data collection, we ultimately exposed our subjects to 2 episodes of each comedy – 1) *The Big Bang Theory* minus laugh track, and *The Big Bang Theory* with laugh track 2) *Friends* minus laugh track,

and Friends with laugh track. The laughter audio track should be around 1 minute in length and was presented as the final piece.

Literature review

Several studies have been conducted about the effect of laughing cues on the audience of a comedy program. Overall, research seems to indicate that the addition of a laughter prompt increases the amount of humour and enjoyment perceived in these programs. An early study from 1975 by Leventhal and Cupchik examined the effects of an audience upon a subject's expressive behaviour and ratings of cartoon stimuli. Previous studies had already shown that audience laughter enhances smiling and laughter. The researchers found within this that a significant difference in males and females exist while evaluating cartoon stimuli. Their research showed that male subjects used the audience laughter as information about cartoon quality, while female subjects based their cartoon ratings on their feeling states. It also showed that these feeling states reflected the pooled impact of the quality of the cartoons and the subject's expressive behavior. Their research makes a contribution to understanding emotional and objective information integration and how social influences affect judgments.

A more recent study from 2009 explored the use of a laugh track in the sitcom "The Andy Griffith Show" to induce a response in the audience (Lieberman et al.). Four episodes of the show were used to measure the reaction of understood humour and the amount of enjoyment from the audience. They used four different episodes to compare varying types of humour, all in conjunction with a laugh track. The authors hypothesized that the audience would find more humour and enjoy the episode more when presented with a laugh track. Ultimately, they found that the addition of a laugh track can moderately enhance the humour of a program, however, only under certain conditions, namely when an episode had a more simple narrative. In other cases with a more complex storyline, a laugh line may even be detrimental.

Furthermore, most studies conducted indicate that different factors can influence a person's way of expressing laughter and his or her evaluation of how funny something is. However, it does not show which laughter cues are the most affective. Most of the research conducted about this topic is based on measuring expressions and rating opinions. We were interested to know if the different ways of perceiving laughter cues are differently processed in the brain. We believe our research can contribute to the current literature about laughter cues by discovering the efficacy of laughter cues and by explaining how the brain processes laughter cues.

Much of the research was all-encompassing as they used both qualitative and quantitative methods to complement each other. However, a fundamental difference lies in the types of materials the individuals were subjected to. Our plan was to use comparable clips with similar 'levels' of overall humor. One will be accompanied with the laugh track, one without and finally an auditory clip of only the laugh track. We hoped to observe the differences in the presence/absence of the laugh track rather than simply compare varying types of humour.

Methods

For our research we wished to explore how the laughter track influences brain activity while observing comedic television programs. Therefore, we selected a small group of subjects on which to test the brain's reaction to laughter triggers. While the participants observe the visual material, we measured their brain activity using EEG headsets, which had 14 electrodes placed over

different hemispheres of the brain. These sensors transformed the signal into alpha, beta, delta, and theta waves that we would later analyse. Special attention was paid to the brain activity that occurs in brain areas that are involved with processing emotions (such as excitement). To investigate if and how the participants react differently to film involving laughter tracks, we showed the participants three different clips. Our three visual materials involved a short piece of a video comedy, a short piece of video comedy with a co-ordinated laughter track and an audio laughter track, independent of film. After collecting data on the brain activity of our subjects, we compared the data from the three different visual materials in order to draw a conclusion concerning our research question.

For this experiment we are sought out two pieces of film that would be internationally understandable. We used a personal computer with headphones to show the two clips to the participants. We used the headphones coupled with a blank screen for the laughter track portion. We recruited 10 participants for this study, and prepared them by explaining that we were conducting a brain wave experiment using short video clips. We did not explain the experiment to the participants in detail, purposely leaving out our intentions with the laughter track.

The procedure we used is as follows: First, we showed one short clip (roughly 1 minute) without laughter. Next, we showed another short clip, also without laughter. After this, we showed a similar type of clip, but this time with a laughter track. Then, the second clip was shown also with laughter. Finally, we showed a neutral, static image on the screen with an audio laughter track. In total, we had 5 pieces for the participants to observe.

Data Collection

During our first session in the Beta lab, we encountered certain problems but were able to collect data from one subject. This data will be removed from our final results because it was influenced by several factors that will be discussed below. In subsequent sessions, we were able to sort out these problems and successfully collected data from ten other subjects.

The troubles we encountered during our first session were all solvable, but very time consuming so we were not able to collect much data on this day. The first concerned the video clips that we were to show to our subjects. The titles of these videos revealed the intentions of our research, which was a scenario we wanted to avoid. We thought that having the subjects know more about our experiment would be problematic because it could shift part of their attention away from the video or could cause them to react differently knowing what we were looking for. In our next session at the Beta lab we solved this problem by asking subjects to close their eyes between videos and only open them when they heard the sounds of the video starting.

The second problem we encountered involved the software used for the collection of EEG data. Our intention was to play the video clips from an external source, while the EEG software would only record data when stimuli are shown within the program. This was solved on a short-

term basis by adding stimuli to the program itself, and thereafter changing the screen display to our video, however, this resulted in varying starting points of our stimuli in comparison to the recording of stimuli by the EEG software. Later on we found a better solution to solve this problem by making our stimuli (the videos) available to play within the EEG software. We gathered the rest of our data from subjects using this setup during our following session.

The third problem that we came across was the fact that our videos are not of equal length. This, unlike the others, we did not need to solve immediately, but will deal with during our data analysis. In order to avoid any ambiguity, the starting and ending points of the video, and our own desired starting and ending point (of equal length for every video) have been noted. The last two problems that required our attention concerned the distraction of our subjects. During our first session the subject was distracted by another project group's activity in the Beta Lab. In our following session we made a reservation to have the lab to ourselves and made sure that there were no other people present in the room than was necessary. Another external influence we found in our first attempt to collect data was the subject touching his or her head during the experiment. Because this might disrupt the data received by the EEG device, in the following session we specifically instructed our subjects not to do this and asked them to move as little as possible.

In conclusion, although we encountered various problems initially, none of them caused trouble to our experiment in the end. On the contrary, all of the problems have been solved or dealt with to our satisfaction. Even though we were not able to collect data that we will use during our first day at the lab, we did gain a lot of helpful information. We learned about the problems with our experiment, which enabled us to find solutions and be better prepared for our next day in the lab. At our following session these problems did not arise and we were able to successfully collect the data that we needed.

Data Analysis

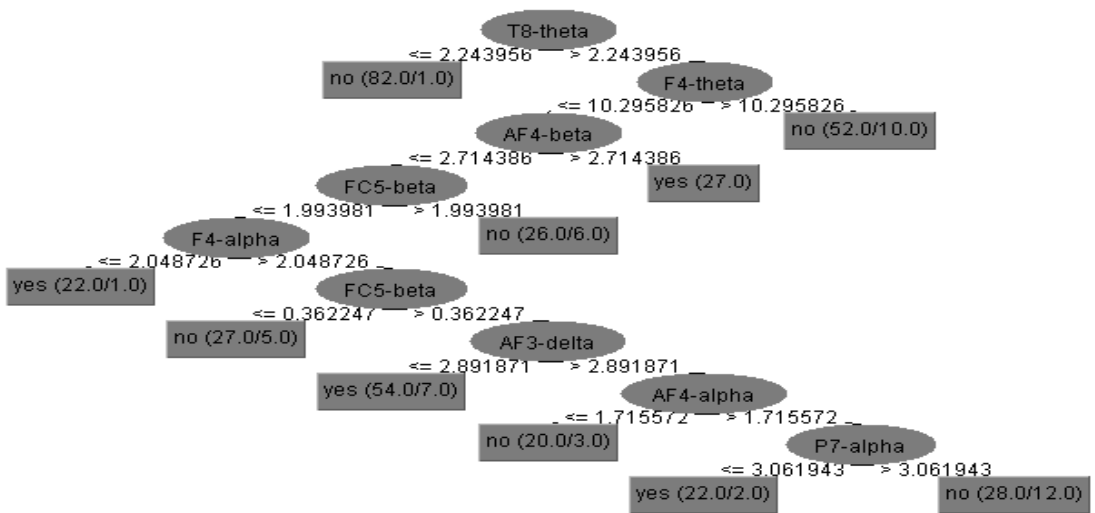
With our research we compared the brain activity of subjects viewing clips including laughter tracks to their brain activity when viewing clips not including laughter tracks. The experiment was set up using EEG headsets with 14 electrodes located on each hemisphere over different brain areas, raw signal transformed into alpha, beta, delta and theta waves. The results of the experiment were recorded in the form of Excel-charts showing the strength of brain wave activity for each of aforementioned signal locator.

Our initial hypothesis was that the most important electrodes of the EEG for us to look at are mainly the electrodes connected to the frontal lobe and near the ears. These electrodes are T7, T8, AF3, and AF4. T7 and T8 are connected to the hearing area of the brain. From here on, it is important to discover if hearing a laughter track triggers a different auditory input in the brain. Electrodes AF3 and AF4 are connected to the frontal part of the brain, which is known for being our

emotional control system and is involved into making judgements (in this case, whether something is humorous or not).

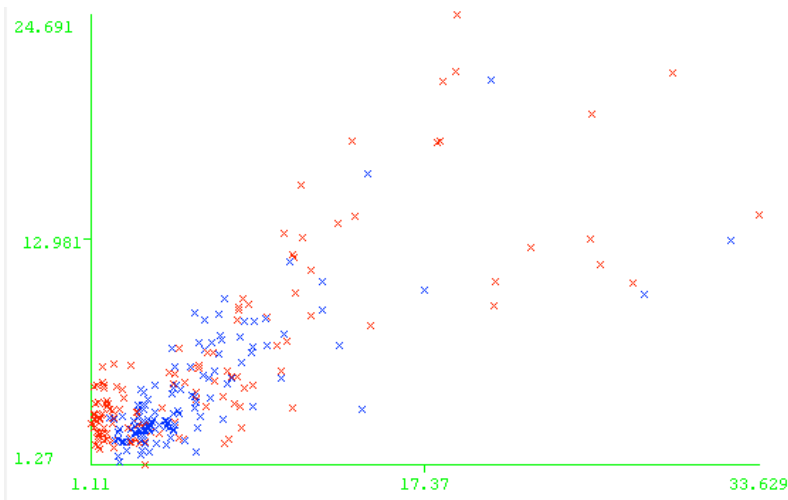
We first focused on the outliers that had to be removed from our data. We did this by selecting values that were outside three times the interquartile range and removing them. Interesting was that the category of clips with laughter tracks contained more outliers than the category of clips without laughter tracks. Overall, 10% of our data were outliers. Thereafter, the visualization was analyzed. Before we started our analysis, we expected to find a larger amount of brain responses for the clips including laughter tracks because we believed the laughter track to trigger extra responses in the brain. However, visual comparison of the amount of brain responses from clips with laughter tracks and without laughter tracks seemed to be relatively equal. Although, it does seem that the clips without laughter tracks correspond with a slightly larger amount of low brain-activity.

Further we made use of the prediction/classification paradigm to analyze our data. With the prediction/classification paradigm, it can be studied to what extend one can predict from the brain activity conducted by the EEG what kind of clip we were showing. In this, we used J48 to conclude more about our data. The J48 is a type of classifier that creates a decision tree. The tree consists of nodes, branches and leaves. The tree shows which receptors the program uses to distinguish the different categories within our data. The J48 also gives a summary of the success rate of paradigm. In the summary of stratified cross validation a significant amount of correctly classified instances can be observed, namely of approximately 78%. This means that the computer was able to classify our data into the correct categories, with the laughter track and without the laughter track, 78% of the time using our EEG data.



Graph 1. J48 pruned tree.

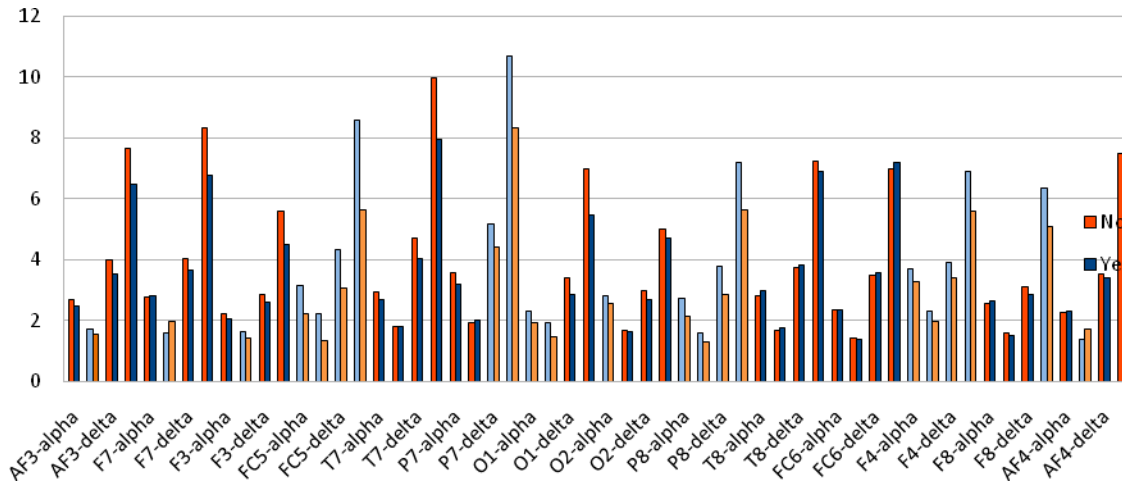
Furthermore, looking at the J48 pruned tree, it appears that the T8-theta electrodes is the most important electrode for differentiating videos with laughter tracks from videos without laughter-tracks. Although no specific literature could be found on the T8-theta electrodes relating to our subject, generally theta waves have been found to show high activity when people actively inhibit excitatory stimuli. The tree shows that low brain activity is an indicator for videos without a laughter track. Relating this to our research it might be the case that people watching videos with laughter tracks actively tried not to laugh. This might be explained by the potential stress of being a single person in the room laughing, even though the clips watched might have been funny. To examine statistical significance of the importance of the change of T8-theta waves we applied T-Test, which unfortunately showed that the difference was rather random and no conclusion can be made on the basis of the changes in this part of the brain.



Pic. 2. T8-theta on the x-axis versus F4-theta on the y-axis.

This graph does not show any significant differences in the brain activity. This means that the T8-theta is only an indicator for categorizing the data showing extremely low brain activity.

To proceed, we made the T-Test for all the results from every electrode, divided into four brain waves, looking for statistically significant numbers when comparing clips with the laughter track and the clips without it. In order for a relation between 2 graphs to be statistically significant, the T-Test result should be under 0,05. In the graph below, the columns in light-blue and orange are statistically significant.



Only the statistically significant results are shown in the table below, in the first row showing the numbers of electrodes, in the second - the relative change of the average brain activity. We highlighted the results that covered all or most of wave lengths for a particular electrode: FC5, P7, P8, F4; as well as the highest relative change of the brain activity, registered in FC5 electrode, and the second place in this category goes to P8 electrode. We also find important the only 2 cases where the brain activity raises, and these cases the relative growth is big enough to be taken into consideration.

AF3-beta	F7-beta	F3-beta	FC5-alpha	FC5-beta	FC5-delta	FC5-theta	
-11%	25%	-11%	-29%	-41%	-29%	-34%	
T7-delta	T7-theta	P7-alpha	P7-delta	P7-theta	O1-alpha	O1-beta	O2-alpha
-14%	-20%	-10%	-15%	-22%	-16%	-25%	-9%
P8-alpha	P8-beta	P8-delta	P8-theta	F4-alpha	F4-beta	F4-delta	F4-theta
-21%	-18%	-24%	-22%	-12%	-14%	-13%	-19%
F8-theta	AF4-beta						
-20%	26%						

Interestingly, in most cases the brain activity in statistically significant cases decreases. Moreover, we consider the statistically significant high relative decrease in FC5 and P8 being the most important result of our experience, and the change in P7 and F4 the secondly important result.

Results

Now we need to interpret the statistical analysis. For this we have to locate which actual brain areas are the electrodes FC5, P8, P7 and F4 referring to.

FC5 relates to Broca's area in the left hemisphere, responsible for language comprehension, action recognition and production and speech production. The activity in this area fell around 33% down when the clips with the laughter track were shown. The strongest explanation of this is that when seeing the same clip for the second time, the participants of the experiment did not have to concentrate and comprehend words and action on the videos anymore, because they just had seen them a minute ago. In the current experiment's design we cannot find out the role of the laughter track alone. It could be a task for the posterior experiment to find out what happens how much the brain activity falls down when the participants watch a video clip two times one after another without any changes in the clips. Possibly, the brain activity in the Broca's area falls down even stronger than when the laughter track is added. That would mean that the laughter track demands some activity in this area, but we cannot conclude it right now.

P8 belongs to the Broadman area 37 in the right hemisphere, otherwise called occipitotemporal area. It is related to processing of color information, face and body recognition, word recognition, possibly to number recognition and within-category identification. The activity in this area falls down by 20%. This findings seem to be similar to the previous ones, where the recognition of words, faces, color information and within-category identification is not as active during the second watch of the video clip as it was during the first time.

P7 relates to the 19th left Broadman area, also called peristriate area of the tertiary or associative visual cortex. This area receives input from the retina, here the visual pathways of "what" and "where" are divided, some motion-sensitive neurons are found here as well as object recognition is supposed to partly happen in this area of the brain. Here the activity falls again, but less than in the instances before: on the average by 15,5%, thus showing that by the second viewing of the clips the information still needs to be processed quite actively. This can be explained by the fact that this area is related to the direct primary visual processing, which happens as much during both the first and the second watching of the video clip. However, other functions of this area, such as object recognition may be less active.

F4 is close to the Broadman area 8, intermediate frontal area on the right side of the brain that includes Frontal eye fields. It is also involved in planning complex movements. Except from the involvement into visual procession, this area is related to some higher functions, such as the management of uncertainty and hope. The activity in this area fell down on the average by 16%. It is unclear how the activity of visual processing has changed, but it is very expected that the uncertainty falls down. In the clip with the laughter track the narrative of the video clip is already known and moreover hints of what should be seen as funny are clearly emphasized.

The described findings are important as they show that during the second viewing of a simple video requires a lot less brain activity. However, we could not identify the particular role of the laughter track yet. This is why we think it is needed to analyse two statistically significant cases of

raising of the brain activity we identified, especially since they relatively raise by a quarter. However, the raise is only observed by one type of wave length, particularly by the beta waves.

AF4-beta is correlated to the Broca's area 9 of the right hemisphere, which is a part of dorsolateral prefrontal cortex, responsible for motor planning, integration of sensory and mnemonic information and the regulation of intellectual function and action. It is also involved in working memory. Damage to this area can result in problems with affect, social judgement, executive memory, abstract thinking and intentionality. In our experiment, when the laughter track was added, activity in this area rose by 25%. This may be explained by the complex social functions that are activated when to respond to the emotions expressed by a supposed group of people. This may also mean that social functions do need a lot of brain activity to be processed and reacted to.

F7-beta is related to 47th, orbital, Broadman area, which is involved into the processing of syntax in spoken and signed languages, and in musical syntax. Here the raise of activity is 26%, which shows that apparently the laughter track activates some of these activities.

Conclusion

All in all, the results obviously did not confirm our hypothesis. There are some conditions, however, that should be taken into account. The results from the EEG data might have been slightly biased as a result of the fact that the clips shown were identical. When the subjects watched the last videos, brain activity might be altered because of habituation. Furthermore, the presence of other people and the performance of other activities in the same room during the experiment might have had a mediating effect on the brain activity, i.e. the subject's attention might have been drawn away from the jokes. Further researched should be conducted, however, on the effects of the laughter track. Apparently, the findings of our research do not confirm the general ideas on the laughter track as it is still widely used throughout television shows and other media. Considering our findings, it seems to be the case that laughter tracks have the opposite effect than stimulating the brain. Therefore, further research should be conducted about the different aspects of the laughter track influencing the brain, and consequently one could consider whether laughter tracks are really efficient stimuli and should still be used in comedy. Lastly, however, our findings indicate possibilities of laugh tracks as means of relaxing the brain – it might be effective in the use of for example stress-relief. This idea however is highly speculative, and further research is required to investigate this idea.

To conclude, we see that, contrary to our initial intuitive feeling, that the brain activity should raise when the laughter track is added, generally it seems to fall down in most brain areas. For the statistically significant results that we have collected, only 2 out of 25 show a raise of brain activity. Moreover, our research using the EEG devices could not clearly show how exactly the laughter works on the neural level and data collected could not prove the effectiveness of the laughter track. However, we have observed that the participants were at least smiling, and many actively laughing reacting to the laughter track. Thus the observation technique, widely used in psychology, justifies

the employment of the laughter track as an instrument to increase popularity of pieces of comedy in various media.

The design of our experiment proposes but does not allow us to conclude for sure that the addition of the laughter track lowers the brain activity. It might be the case that the brain activity is lowered because the clips with and without the laughter track were repeated, therefore causing habituation.

Necessarily, further research should be conducted on the effects of the laughter track. Most importantly, the laughter track should be separated as many other factors as possible. Only after those experiments one could question whether laughter tracks are really efficient stimuli and if it should still be used in comedy. Furthermore, our findings indicate possibilities of laughter tracks as means of relaxing the brain – it might be effective in the use of, for example, stress-relief. We all know that proverb that those who laugh live longer. Maybe this is because of the brain relaxation. This idea however is highly speculative, and further research is required to investigate this.

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