Telepathy☆

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Abstract

Telepathy is a familiar concept in our daily lives. We usually mention it as a hidden connection between people. Precisely speaking, it is the transfer of information between people without the use of any physical interaction. There are exact papers published regarding this problem and made some arguable results, but we think they did not consider some aspects which can be overly effective. Usually, telepathy occurs between people with strong common feelings like closed people. In the present study, we tried to consider these aspects. Consequently, we designed a new experiment and collected data from ten pair subjects. The main goal of our study was to reach some new results and facts about telepathy using data analysis methods. Predictably, the p-value of our test is not statistically significant to accept the hypothesis which is telepathy exists.

1. Introduction

Telepathy is a phenomenon that all people have probably faced in their lives. Making connections among people without using any human sensory channels is a good definition for this notion (1). It is generally interpreted to be pseudoscience because of the lack of appropriate control of different impacts in experiments designed to measure telepathy. Additionally, it can play an important role in mind-body debate whether it is proven or not. If it is proven, it can start a totally new branch of science and if it is not, it can reject many possibilities in human life.

One of the most famous experiments which are conducted about telepathy is the ganzfeld experiment. The design of their experiment is as follows. At each experiment, two subjects are separated into two different rooms. A movie or a picture is showed to one of them and this subject has to send information to another subject mentally. The other subject has to describe what he or she has received. (2).But there exists also some issues which scientists have pointed out about their design of the experiment. One of the important ones is that the video or photo, generally the stimulus, is not generated randomly, resulting in bias problems. (3)

In this study, the phenomenon is investigated with a different approach, and assuming some aspects we believe are essential in telepathy study. The study is done using data analysis tools, such as multiple statistical tests, regression analysis and principal component analysis. The goal is to find remarkable engaging and meaningful relations between different parameters affecting telepathy. First, it is explained how the data is collected and then we analyze the data step by step to discuss whether we can find a relation or not.

2. Results

2.1. Materials and Methods

At first, we explain detail of experiment design.

2.1.1. Experiment

In the experiment, we had a pair of subject that did not have any physical interaction in a room. Each

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experiment had two rounds. At each round, there were twelve trials (this choice of design is explained in the power analysis section) where one of the subjects (sender) was stimulated by putting their hand into either cold water or warm water. At the first round, one of the subjects got the role of a sender, who was suffering from the pain of cold water or calming with warm water, attempting to send feelings to another subject, while the other one got the role of a receiver, trying to receive another subject's feeling, who had to specify current co-subject mood at each trial. In the second round, vice versa had happened.

For twelve trials, we generated a random sequence of six cold trials and six warm trials (this choice of design is explained in the stimuli section). At each trial, the sender was asked to put one hand in one of the cold or warm water according to a generated random sequence for twenty seconds. Then he or she could pause for fifteen seconds resting, and then put the hand in warm water again. Moreover, the experimenter asked the sender to announce with the other hand a number from 0-5 as his pain rate on that trial. (Sender did not talk).

At the end of each twenty seconds trial, another experimenter asked the receiver to write the current sender's feeling. The receiver had to write "+" if the sender was calm and "-" if the sender was suffered.

2.1.2. Subjects

As it was mentioned, we wanted our subjects to have common feelings. So we selected 10 pairs of subjects from people such as twins and close friends. The range of their age was between 19-22 years old(16 male and 4 female). Instructions given to subjects were written in the experiment section.

2.1.3. Stimuli

As it was mentioned, the final stimulus for a round was a random sequence of 6 cold stimuli and 6 warm stimuli. In order to generate a random sequence, we assigned a random number coming from a uniform distribution between 0-1. Then we sorted the 12 stimuli according to their random number.

One of the parameters regarding the stimulus was the temperature. Warm water was 37 degrees Celsius and cold water was zero degrees Celsius. Additionally, we considered the time of each stimulus which was twenty seconds is another parameter

2.1.4. General Data

Furthermore, we have collected some data about the closeness of subjects, their belief about telepathy, common life experience, meditation history, and how long they have known each other.

Consequently, we used that information as different features in a corresponding feature space, making it possible to analyze the data in the following sections.

2.2. Results

2.2.1. Power Analysis

Moreover, a power analysis was done before experimenting and collecting data. In power analysis, our experiment is like a binomial process, made up of trials which are Bernoulli random variables. Hence, One can find out the power of this process for different processes. It means for different values of the parameter of a binomial distribution, which we do not know in advance, how many samples we need to reach the desired confidence interval, which is 95 percent, rejecting the null hypothesis. Note that our alternative hypothesis is that the parameter of the Bernoulli distribution, μ, is not completely random which means $\mu > 0.5$. As it

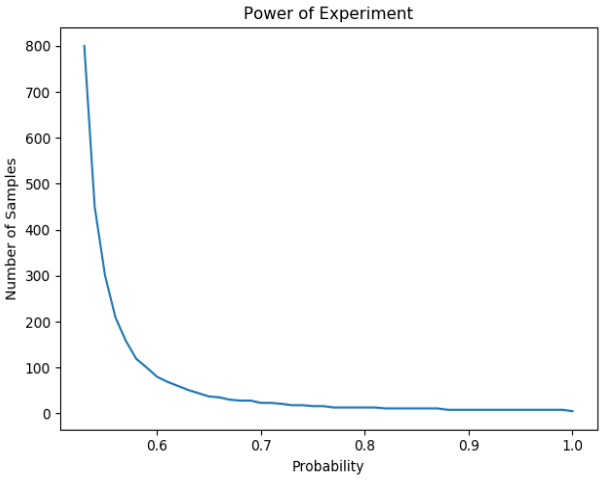

Figure 1: Power Analysis of Binomial Distribution

is clear in Figure 1, for probability=0.5, which can be a good choice for prior knowledge about each trial, we require numerous samples, even more than 800. However, the interesting thing to mention is that there is a rapid drop in the chart which reaches to only 100 samples around probability = 0.6, meaning that we only need 100 samples to detect telepathy. Although that is not consistent with our null hypothesis, according to our limitation of huge sampling in the experiment, we thought that 12 trials in each round could be good (with respect to the number of our pairs). Of course, this parameter is not assigned rigorously.

2.2.2. First Look

At the first step, we take advantage of the data of each round (19 rounds totally, one experiment was done just one round), not each trial. The purpose of this is that to aggregate the total feelings of pairs in all of the trials (a round) that they participate. In this way, we maybe reduce the noise people may have in their estimations. Accordingly, we calculate the number of correct answers and average pain rate in each round.

Now the question is, which features have a significant correlation with correctness. In order to answer, an important feature to examine can be the average of pain, as that factor is always taken for granted as kind of a source of telepathy between close persons. The linear regression between averaged pain and correctness (number of True in each round) can be seen in Figure 2. There are some outlier points in the regression, suggesting that further analysis is required, However, the positive slope is consistent with our expectations, meaning that if we increased the average pain, we would expect to obtain more correct answers. To be more rigorous, we check the correlation heatmap.

As you see in Figure 3, num.of.True or correctness seems to have a good correlation with pain rate. Hence, we check the significance of this correlation, by using cor.test in R to calculate the correlation coefficient and p-value. The calculated p-value became 0.09 which is so close to the significance level, but it is not significant eventually.

Note that the correlation between total correctness and average pain rate in that we averaged for each round, is not equal to the correlation between pain rate and correctness in the whole dataset, where all trials

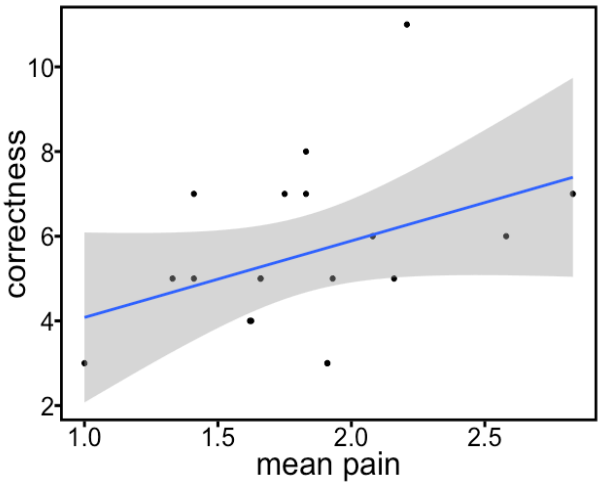

Figure 2: Linear Regression between correctness and mean pain in averaged state

are together. Actually, we wanted to check whether there is something meaningful in the averaged cases, which we see that there is not. Subsequently, we go forward and look at the raw dataset, where each trial exists independently.

2.2.3. Principal Component Analysis

In this section, we want to investigate the whole dataset with all features collected from the whole experiment. First, we look at the correlation heatmap between all features. As you see in Figure 4, there exists some obvious correlation which is not related to the goal of our study. As a relevant preprocess, we want to use principal component analysis for dimensionality reduction and find out whether there is any cluster or subpopulation in our samples.The figure of points in a space of 2 basis, PC2-PC1 is in Figure 5

In Figure 5 is seen almost 5 clusters if we don't consider the outlier point. In order to understand the clusters better, we find the common features that make these clusters. Consequently, we intend to find out common features based on Principal component 1 and principal component 2, which can be found in Figure 6. It seems that there is nothing meaningful in them. The reason for that is maybe that the variation of the third principal component is also high.

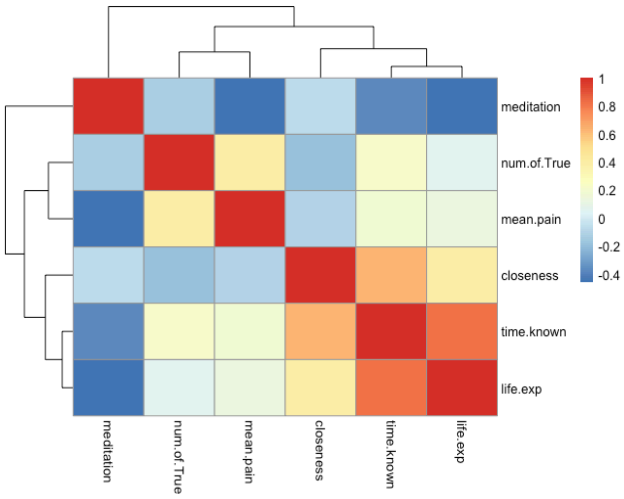

Figure 3: Correlation heatmap in averaged state

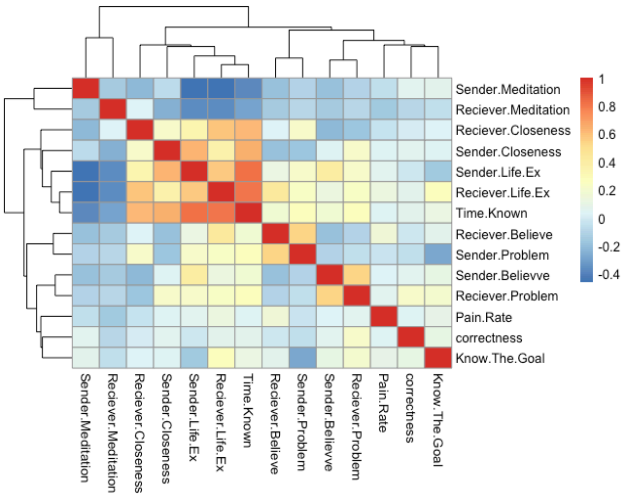

Figure 4: Correlation heatmap in whole data set

2.3. Hypothesis Test

Finally, we check the hypothesis of telepathy existence. The null hypothesis is that telepathy does not exist (or$\mu = 0.5$) The alternative hypothesis is that telepathy exists (or $\mu > 0.5$). To check the hypothesis, we apply a t-test since according to the Central Limit Theorem, the mean of i.i.d random variables is normal and the number of samples is sufficient. The calculated p-value is 0.4625551 with a 95 percent confidence interval which shows that we can't reject the null hypothesis.

Another interesting hypothesis to test is whether the condition of the water, either being cold or either being warm, affected the prediction of the receiver or not. we apply the fisher test to check this phenomenon. The p-value calculated in this test is 0.89, meaning that the coldness or warmness of the water doesn't make any difference. Subjects choose totally by chance.

2.4. Discussion

At this experiment, we tried to repeat the telepathy experiment with a new approach. We incorporated some new features to the experiment such as the closeness of subjects and the pain that the receiver had in each trial. But in our investigation, there was no significant relationship between the parameters we used. Accordingly, the hypothesis of the existence of telepathy was refused as it was predicted. Even in the fisher test, the test shows subjects choose randomly, independent of the condition of the water. But something notable that we possibly have to care about was the fact that there was a good correlation between averaged pain rate in each round of experiment and the total correct predictions by the receiver, even though it was not significant if we assume the significance level 0.05.

In this experiment, we tried to change some aspects which were not considered seriously in previous experiments such as having deep common feelings. Also unlike previous experiments, we tried to change the stimulus to something that can make a deep physical feeling for the sender instead of videos and photos which are very abstract. Our experiment similar to other experiments could not show the existence of telepathy and could not find any relation between telepathy and a specific parameter. Another common characteristic of our experiment and previous ones is that there are many parameters that cannot be controlled because of the intrinsic traits of the telepathy phenomenon itself.

Our approach was a simple approach and further research can combine the ideas of subjects with common feelings and previous researches and design a new experiment.A flaw in our experiment was that the number of experimenters during the experiment was large and

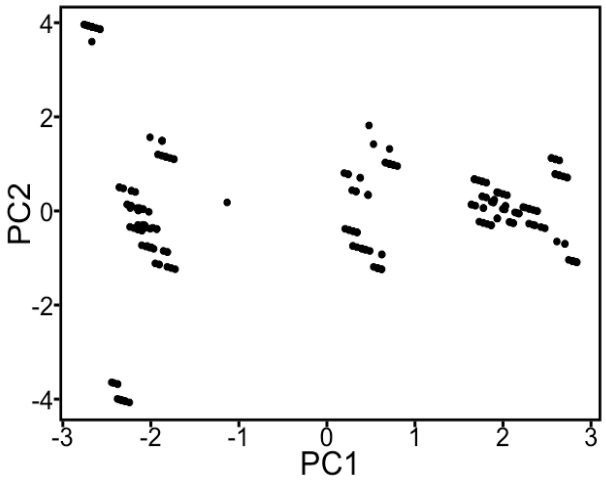

Figure 5: Principal Component Analysis of Data

it possibly made a distraction for participants. Moreover, the stimulus we selected might not be quite effective; therefore further experiments can address the problem by taking advantage of stimuli that can arise feelings more. Furthermore, as we discussed in the power analysis section, the number of participants was fairly low which can simply produce a source of error in our analysis. Therefore combining good ideas from different experiments may lead to better outcomes for this problem

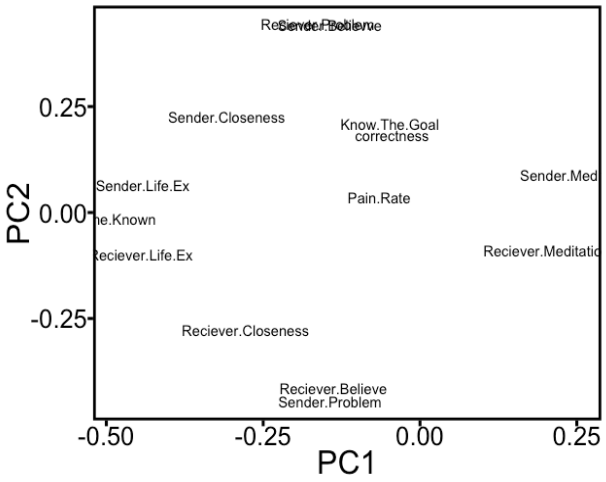

Figure 6: Principal Component Analysis of Features

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