

The cover features a white background with a large, diagonal, red and white striped pattern that runs from the bottom left towards the top right. The stripes are thin and closely spaced. In the top left corner, there is a vertical red bar. The text is positioned to the right of this bar. The bottom of the cover is divided into two triangular sections: a dark grey one on the left and a red one on the right.

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TABLE of CONTENTS

ii **Editorial Board**

iv **Editor's Note**

Eylül Turan

EXPERIMENTAL ARTICLES

1 **Spatial Hearing and Emotion: How auditory angular position of a daily discussion affects emotional reaction**

Yağmur D. Kısa, Ekin Kösegil, Tolga Yapan

11 **Emotional Valence and Memory: Effect of Verbal Stimuli with Emotional Valence on Working Memory Performance**

Merve Tansan, Irmak Hacimusaoğlu, Cemre Gülmez, Yasemin Aslı Yalçın

19 **Self-esteem and Financial Risk Taking**

Alara Çamlıbel

25 **Phone Use During Dyadic Conversations Decrease Perceived Politeness Despite Social Attraction**

Nesrin Naz Aydın

REVIEW ARTICLES

33 **An Elaborative Review on Imaginary Companions and its Possible Connection to Theory of Mind**

Erim Kızıldere

47 **No Other Brain for the Second Language: Why We Should Not Rush to Settle Bilingualism on a Certain Brain Region**

Ege Ekin Özer

EDITOR'S NOTE

It is a great honor to present the first issue of *Koç University Undergraduate Psychology Journal* (KUUPJ). This journal is an undergraduate student journal, which aims to create a platform in which psychology students can publish their own work and be informed about the studies of fellow students.

Every psychology student at Koç University is obliged to take two courses in which they are required to conduct a study. Besides this, students have the possibility to take an “independent study” course, where they can complete their own research with one of our psychology professors. We aim this journal to be an initiative, which ameliorates undergraduate studies beyond coursework, and allows students to publish their studies, making it possible to judge personal accomplishments, while improving their academic skills and sharing their effort with one another. With this incentive in mind, we decided to create the *Koç University Undergraduate Psychology Journal*.

This first issue was created by a small but a very enthusiastic team of undergraduate students who strived quite a bit and tried their best in choosing the most outstanding articles, reviewing them, and creating an aesthetic platform to share this effort.

I want to thank my fellow editors for their detailed work but more importantly for their commitment and faith in creating this journal. Even though none of us possessed any experience about publishing a journal, equipped with our cooperative and diligent work we managed to create our psychology journal. We are very grateful to our advisors Dr. Tilbe Göksun and Dr. Fuat Balcı for their guidance and counseling. As the KUUPJ team, we also want to thank the Department of Psychology of Koç University. Lastly, we want to thank our authors for their valuable work.

Our first issue contains four research articles and two review articles. These articles are mainly about cognitive psychology and include topics such as bilingualism, theory of mind, and working memory. We hope that this initial issue will inspire fellow students to share their work and be a part of this community, and form the outset of a continuing tradition.

Eylül Turan

Spatial Hearing and Emotion: How auditory angular position of a daily discussion affects emotional reaction

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What is the effect of auditory angular position of a daily discussion on emotional reaction? This study investigates participants' emotional reactions to a daily discussion. We construct three different direction conditions of a pair of sound sources, which are stated in the front, back, and at the two sides. From 20 to 23 year-old ($N=48$) university students were requested to fill a survey after listening the discussion. We scored the intensity levels and emotional reactions of the participants via two different scales. We also measured two different dimensions of the second scale as being Activation, and Pleasantness. Participants' scores are tended to show mostly an interaction effect between direction conditions and sex. The difference is found to be in the source direction condition that of at two sides compared to front and back conditions. This study provides a new way of thinking of presence in relation to direction by also pointing to the role of sex.

Keywords: spatial arrangement, presence, emotional reaction, auditory perception, activation, pleasantness

In our daily experience of discussions, we are guided by many factors in terms of evaluating those events such as the spatial distance of the subjects to each other, the context in which the discussion takes place, subjects' gestures and other ways of expressions to communicate ideas to each other. In daily life, we might first tend to think that what structures our evaluation of that discussion is related to visual cues and the very content of the discussion, but we claim that spatial arrangement of the subjects and mere auditory exposure to a discussion can be factors affecting our perception of that relationship and communication. While visual input is not always available, we can track changes and events taking place in the environment through our hearing of them. The events

taking place outside of our visual field still have an effect on us, they are still present as auditory events that come from a certain direction, a certain distance, with a certain loudness and sound quality. Thus, the spatial arrangement of an event that is available to vision and audition or merely to the latter can affect our ways of relating to that very event and our subjective evaluations of it. More fundamentally, what is visual and what is auditory are so intertwined in experience, we underestimate the presence of world as an auditory environment. In the present experiment, we aim to emphasize the role of auditory spatial arrangement on our evaluations of a daily discussion and on our emotions, such as feelings of intensity, activation and unpleasantness.

Previous experiments focused on subjects' processing of auditory information (Konishi, 1993; Shaw, 1996), on the ability to create a virtual auditory environment in the absence of any visual feedback (Västfjäll, 2003; Freeman, et al., 2001), and on the effect of environment on emotions in the context of visual perception (Mühlberger et al., 2008). Our aim is to focus on the subtler and uninvestigated ways of environment's acting upon us in terms of our emotional evaluation of that very environment. We specifically aim to investigate the effect of auditory angular position of a daily discussion on emotional reaction.

Spatial hearing is a perceptual phenomenon that demonstrates intricate acuity and competence in terms of localizing sound sources by their directions and thereby is as important as vision in terms of shaping our experience of the world around us. Spatial hearing enables us to be responsive to even invisible dangers; thereby in contrast to vision our auditory system shapes our vigilance regardless of the availability of visual input that is largely dependent on our attentive decisions of directing our visual field to a target (Konishi, 1993). The ubiquitous nature of spatial hearing reveals the importance of research in this field to have a better insight into our understanding of spatial environment, as a contribution to the vision studies dominating the literature. Spatial hearing studies can be traced back to 1930s with researchers trying to understand the auditory relation between the position of body segments and a sound source (Pearce, 1937).

More recent studies mainly focused on the contribution of auditory cues and the very nature of binaural hearing on the acuity of spatial hearing in terms of both

horizontal and vertical planes, thus they focused on the analysis of the process of spatial hearing (Konishi, 1993; Shaw, 1996). Spatial hearing is based on two important dimensions: processing of frequency and detection of direction, the latter being the focus of our study (Konishi, 1993). Thanks to the structure of inner ear we are able to detect spectral prominences that enables selectivity and sensitivity to different types of sounds (Konishi, 1993). More importantly, our detection of auditory direction is mainly made possible by the nature of binaural hearing that enables to make use of difference in arrival times at our ears making angular direction discrimination possible in the horizontal plane thanks to its high time resolution. Although there is no difference in terms of arrival time to two ears and difference in intensity in the case of vertical directional discrimination, we are still good at vertical discrimination too in which head motions are shown to be not responsible (Konishi, 1993). The possibility of anterior-posterior (vertical plane) differentiation thanks to the role of external ears, including the auricles and ear canals, due to their baffling and funneling effects has been shown, which constitutes another cue for sound localization in addition to commonly acknowledged effect of the interaural disparity (Shaw, 1996).

The main importance of those spatial hearing studies is the demonstration of spatial hearing as a reliable way of representing the environment with acuity in directional discrimination by pointing out to physiological and perceptual cues enabling that competence. Particularly the experiment conducted by Shaw (1996) is relevant to our study in the sense that experimenters used a horizontal sound localization design and have shown the fact that

participants were able to *discriminate* directions with high accuracy in the control condition even though horizontal plane was divided into twelve parts, which required a detailed discrimination. Moreover, our study aims to measure the effect of this competence in direction discrimination on participants' experiences of a daily event, thus rather than focusing on the nature of auditory processing we aim to investigate the effect of the very presence of such auditory competence on shaping our experience. More specifically, we aim to investigate the effect of auditory competence in direction on shaping our evaluative and emotional reaction towards a daily discussion that is heard from three different horizontal directions.

In common experience we are exposed to visual and auditory environmental inputs simultaneously, but experiments using different types of sound sources showed that in experimental situations without visual feedback one is able to construct a virtual reality that is very much like actual spatial hearing, thus spatial hearing independent of visual perception constitutes an environment that can be virtually created to represent real spatial hearing and constituting a sense of presence (Västfjäll, 2003; Freeman et al., 2001). In the experiment conducted by Västfjäll (2003) the differential effects of mono, stereo, and six-channel sound systems, thus that of different degrees of spatialized sound, on emotional reaction to auditory environment, emotion recognition, and ratings of presence are measured. As an auditory stimulus, music expressing negative emotions was used. Stronger emotional reaction change was observed in stereo and six-channel reproduction conditions, whereas in terms of emotion recognition and presence six-channel reproduction

showed higher effects. Thus, it has been observed that both emotional reactions and sense of presence increased with the number of audio channels that assumed to be due to their increasing power of representing a real auditory environment. Apart from their variance dependent on the type of auditory virtual environment, emotional reactions and ratings of presence showed a significant interrelation, which is not explained causally. Most of the studies in auditory perception focus on the effects of certain subjective psychological states or certain cues on hearing distortions, whereas this study measures the effect of an aspect of hearing on emotion, thus reversing the paradigm, as we are going to measure directional aspect of hearing on emotion. Since we will also create an auditory virtual environment and will use a stereo sound system, the fact that stereo is shown to be as effective as six-channel reproduction in terms of emotion reaction shows the reliability of our tools in terms of representing reality.

Apart from the value of stereo sound system in terms of getting close to a realistic representation, which is the main focus of the study of Västfjäll (2003) that is limited to the spectrum of artificiality and reality, in our study we focused on different degrees of presence and reality in terms of changing direction, which can be a basis for a discussion in terms of varying degrees of presence.

Another experiment by Freeman et al. (2001) have tried to show the effect of the character of a sound on the ratings of audio-related enjoyment and the sense of presence. They manipulated the bass, volume, and the channels of the sound. At the end, the most important finding was that inclusion of bass to the sound was significantly increasing the ratings of presence-

related variables. Volume has also been found to have more or less the same effect, with no significant rating difference found for the manipulation of channels. Here, again the notion “presence” is held in the sense of feelings of “being there”. The experiment again focused on constructing a real world like environment and on the effect of auditory changes on ratings of presence, again not touching upon varying degrees of presence.

Our conceptualization and broadening of the notion of presence includes not only feelings of reality, but also our emotional and evaluative reactions to an auditory event, which is thought to be subject to change based on the auditory direction through which participants were exposed to the auditory event. We thereby predicted that there could be varying degrees of feelings of presence, which can be measured through participants’ evaluations of the intensity of the discussion, which would reveal how much they were involved with the auditory stimulus.

In a visual perception study (Mühlberger et al., 2008), rather than auditory perception studies outlined above, the effect of the distance of unpleasant stimuli on emotional response was investigated, which is parallel to our study in terms of the usage of unpleasant stimuli and the effect of the spatial arrangement of that stimuli on emotional responses. The experiment mainly showed that change in spatial distance of an unpleasant picture arouses negative emotions. It is shown that emotional reaction to approaching unpleasant stimuli is more intense than to static and receding stimuli. The authors draw a positive relation between the motivational significance of the object that is affected by the closeness of the object and the very emotional response that unpleas-

antness and distance creates. The actual distance was shown to be determining the emotional intensity induced by the object. Besides the intensity, it was important to show that the intensity comes along with the vital significance due to changing distance. Thus, along with visual stimulus being unpleasant, authors assume the presence of a deeper mechanism that shapes our avoidance from and reaction to an unpleasant object. So, the observer is assumed to have a kind of implicit motivation, as mentioned in the article, a motivational significance of the object. The experiment seems to show the effect of so called outside on inside both in terms of mere emotional reaction and motivational significance contributing to that reaction.

As different from the mentioned study (Mühlberger, et al., 2008), we focus on spatial hearing rather than spatial seeing, and on the significance of direction shaping our experience of an unpleasant event rather than the distance of it. However, still a parallelism can be drawn between two experiments that are conducted based on different sensory modalities and different aspects of the spatial arrangements of the events in the environment in terms of two aspects: on the one hand by means of showing the significance of auditory perception and the importance along with the competence of auditory environment on emotional reactions and on the other hand pointing out to directional arrangement as important as distance in terms of being an effective factor on shaping our relationship to environment with varying degrees of emotional significance attributed.

All in all, our hypothesis suggests that the directional localization of sound sources at two sides, in the front and in the back, will differentially affect the intensity

rates of a daily discussion that was listened by participants. More specifically, we predicted the localization of sound sources at two sides to increase the perceived intensity of the daily discussion. We predicted participants to report feelings of unpleasantness and activation in reaction to the auditory stimulus that was measured by our second scale. We also expected participants in sides condition to give higher ratings of intensity which was measured by our first scale including questions about their evaluations of the intensity of the discussion in terms of how severe was the discussion as a discussion and as a future predictor of the fate of an ongoing relationship and finally as a factor that would affect their involvement with the discussion. Thereby, we predicted that spatial direction would affect the judged intensity of the discussion along with participants' emotional reactions in terms of activation and unpleasantness.

Method

Participants

The total sample consisted of 48 university students with an average age of 21.19 and standard deviation of 1.53 who were evenly separated into three groups for three different sound source direction conditions: front ($M=21.31$ years, $SD=1.45$, range: 19-25), sides, and back ($M=21.06$ years, $SD=1.65$, range: 18-24). Additionally, in terms of sex, the sample consisted of 21 female and 27 male students, with 9 male and 7 female students in each of three direction conditions. Based on the content of the sound stimulus, a discussion between two young adults (one female and one male), the age groups of the participants were chosen from young adult age groups, more specifically

from Koç University undergraduate students. 5 of the participants gained one credit for their Introduction to Psychology course due to their participation to study. The scores on five items in the second scale for two participants, one in front and another in sides condition, were missing due to experimenter error and therefore those items were excluded from the analysis.

Materials and Measures

Sound sources were placed in each condition in such a way that subjects were at the center of a circle whose radius was at a constant distance (195 cm) between the subject and the sources. Participants were exposed to a daily discussion produced by a pair of stereo speakers (Presonus E8) from a certain angular position (front=45°, back=45°, sides=180°), depending on their experimental group condition. The daily discussion included two persons (one female, one male) arguing and expressing negative emotions towards each other. The daily discussion was 102 seconds long. Sounds of female and male discourses were separated into two channels, coming from two different speakers: female coming from left and male coming from right in each condition.

After the exposure to auditory stimuli subjects were given 2 surveys measuring the perceived intensity of the discussion and their emotional reaction. We generated a questionnaire consisting of four items which corresponds to the first scale. First three questions are intended to measure the perceived intensity of the discussion and the fourth one measures the level of feelings of involvement additionally. Namely, we wanted to measure the effect of direction condition on participants' evaluations of the discussion in

terms of the intensity of the discussion and on whether they felt to be involved in the discussion or not. Second item on the scale was reversed and all four items were summed to get an intensity score.

Moreover, as a second scale, we used SCAS (The Swedish Core Effect Scale) (Västfjäll, 2001) including 12 bipolar adjective pairs in order to measure participants' emotional reaction to auditory stimulus in terms of two dimensions: activation and pleasantness. The original scale has an acceptable reliability (Chronbach's alpha ranging from 0.87 to 0.93). The first three items defined by the adjective pairs dissatisfied-satisfied, sad-glad, and depressed-happy were included to represent unpleasantness/pleasantness. The second three items defined by the adjective pairs sleepy-awake, dull-peppy, and passive-active were included to represent deactivation/activation. The third three items defined by the adjective pairs bored-interested, indifferent-engaged, and pessimistic-optimistic, were included to represent pleasant activation/unpleasant deactivation. Finally, the fourth three items defined by the adjective pairs tense-serene, anxious-calm, and nervous-relaxed were included to represent unpleasant activation/pleasant deactivation.

We adopted those bipolar adjective pairs to Turkish and computed two different scores from them based on pleasantness dimension on the one hand and activation dimension on the other hand. Since we predicted participants' emotional response to reflect unpleasantness and activation, rather than pleasantness and deactivation respectively, we first summed the scores of 9 adjective pairs that included pleasantness dimension (thereby excluding the second three items that only represent activation) by first reverse-coding all the

items to get an unpleasantness score. More specifically, in order to find unpleasant dimension score we summed dissatisfied-satisfied, sad-glad, and depressed-happy, bored-interested, indifferent-engaged, and pessimistic-optimistic, tense-serene, anxious-calm, and nervous-relaxed scores (reversed versions of all 9 adjective pairs). Again, in accordance with our expectation of activation in participants in response to hearing the discussion we summed the scores of 9 adjective pairs that included activation dimension (thereby excluding the first three items that only represent pleasantness). More specifically, in order to find activation dimension score we summed sleepy-awake, dull-peppy, and passive-active, bored-interested, indifferent-engaged, and pessimistic-optimistic, tense-serene, anxious-calm, and nervous-relaxed scores (reversed versions of last three adjective pairs). Both for the questionnaire and the scale we used Likert scale (1-7).

Procedure

The experiment consisted of three different direction conditions (front, sides, and back) where the directional position of sound sources differed which constituted the three different participant groups. Two scales were handed in the same manner to all participants.

First Experimental Group/ Condition 1:

First of all, participants were given the consent form and were informed about the experiment that they will be blindfolded, will listen to a daily discussion, and then will complete a survey and about the duration of the experiment which is between five and ten minutes and the specific duration of the sound recording. After signing the consent form, with the guid-

ance of the first experimenter, participants were led to a 40-square meter room where the sound sources were placed. Before entering the room, participants were blindfolded with a scarf to avoid seeing the directional location of the sound sources inside the room and they gave feedbacks confirming not seeing anything. With the help of a second experimenter, participants were carefully directed to avoid any possibility of injury due to not seeing, and they were thus located at the center of the sound sources (located at the sides of the participants) sitting on a chair. Second experimenter made sure participants were comfortable as sitting blindfolded on the chair by asking “are you feeling comfortable?”. Upon participants’ confirmation, the second experimenter stated “If you are ready, I will start recording”, and once participant confirmed, the recording of the discussion was started. After listening to the discussion of a heterosexual couple arguing about their relationship, participants were again guided by the second experimenter, being still in blindfolded condition, and thereby taken to a chair and a desk behind a screen in the same room where they were requested to fill the survey after untying the scarf that covered their eyes. Thus, participants while completing the survey still did not see the location of the sound sources and the location of their previous position through the screen preventing the view. First the scale one was given and when it is completed experimenter provided the scale two in all conditions. Then, demographic information (age and sex) was written on the front page of the survey along with the participant number and the school IDs of the participants if one is participating in the study for psychology course credits. When the survey was finished, participants

were free to see anything in the room and were debriefed about the experiment.

Second Experimental Group/ Condition 2:

What differs in this section was only the positions of the sources which were situated in front of the participant.

Third Experimental Group/ Condition 3:

What differs in this section was only the positions of the sources which were situated at the back of the participant.

We collected the data via two scales for three different direction conditions in three sessions. The type of the sound source used, the volume, the distance between participant and the sound source and the room used were same for all conditions. There was no other sound or noise other than the recording either inside or outside the room. The instructions given by experimenters were standardized. In addition to extraneous variables that were controlled for, our main manipulation was changing the direction of sound sources, thereby giving different sound source direction conditions to three different groups. Participants were randomly selected from the population of Koç University.

Results

We first analysed participants’ total scores on the first scale in terms of the effect of sex and direction manipulation. A two-way ANOVA analysis with independent samples showed that in responses (M -front=14,127, SD =.693); (M -sides=13,056, SD =.693); (M -back=14,730, SD =.693) there was no significant difference among direction conditions, $F(2, 42)= 1.500$, $p>.05$. We also found that comparing male’s (M =13,370, SD =.529) and female’s

($M=14,571$, $SD=.600$) scores on the first scale, there was no significant difference between them, $F(1,42)=2.256$, $p>.05$. However, a significant interaction effect of direction condition and sex on the first scale scores was observed, $F(2, 42)=5.008$, $p<.05$. More specifically, Post Hoc tests demonstrated that the mean total score of females on the first scale in sides-condition ($M\text{-sides}=12$, $SD=1,632$) was significantly lower than front-condition ($M\text{-front}=16.14$, $SD=2.544$) with $p<.01$ and back-condition ($M\text{-back}=15.57$, $SD=1.039$) with $p<.05$. Namely, no main effect of direction or of sex was observed on total scores on the first scale, however the interaction between direction condition and sex significantly affected the scores, more specifically females tended to score lower on sides-condition compared to other direction conditions.

We further investigated the scores in terms of the activation dimension on the second scale, a two-way ANOVA analysis with independent samples showed that there was not a significant main effect of sex $F(1, 40)=.120$, $p>.05$ or direction $F(2, 40)=.209$, $p>.05$ on activation scores, whereas there was a significant interaction effect of sex and direction condition, $F(2, 40)=3.789$, $p<.05$. Thus, no main effect of either sex or direction condition was observed, however the interaction between sex and direction condition showed a significant effect on participants' scores rating their feelings of activation as their emotional response/reaction to the discussion.

A further two-way ANOVA analysis with independent samples measured the effect of sex and direction condition on the scores in terms of pleasantness dimension on the second scale. A marginally significant effect of sex ($M\text{-male}=4.78$, $SD=.748$)

($M\text{-female}=5.26$, $SD=.982$) on unpleasantness scores was observed, $F(1, 40)=3.613$, $p=0.65$, whereas there was no significant main effect of direction, $F(2, 40)=1.064$, $p>.05$. Additionally, there was no significant interaction effect of sex and direction condition on the unpleasantness score. Thus, only a marginally significant effect of sex on unpleasantness score was observed, more specifically females ($M=5.26$, $SE=0.21$) reported higher scores of unpleasantness compared to males ($M=4.78$, $SE=0.16$) as their emotional response to the discussion.

Via two-way ANOVA we further analysed the effect of sex and direction on the score of the fourth question on the first scale, and observed that there was a significant effect of direction ($M\text{-front}=3,50$, $SD=.411$), ($M\text{-sides}=2,15$, $SD=.411$) and ($M\text{-back}=3,71$, $SD=.411$), $F(2, 42)=4,275$, $p<.05$. However, there was no significant main effect of sex, $F(1, 42)=1,155$, $p>.05$, whereas a marginally significant effect of interaction between sex and direction condition was observed, $F(2, 42)=3.017$, $p=.06$.

Discussion

Findings explicitly show that the interaction between direction condition and sex plays a grand role in interpreting the data. In the first scale where we aimed to measure the overall intensity of the discussion, we found the interaction effect to be significant. More specifically, female participants who received the sound at sides were to find the discussion less intense than those who received it from the front and back. At this point, our hypothesis expecting significantly higher score from people who received the sound at sides is not confirmed but the reverse, with

a relation to another variable which is sex of the participant. To make the fact intelligible, we analyzed other data. Further analysis showed a parallel relation between the first scale and the activation dimension of the second scale. The results of the activation part followed the same patterns as found in the results of the first scale such that there was a significant effect of the interaction between direction conditions and sex. We may conclude that the more activated the participant was, the more intense they felt about the discussion, and vice versa.

To this point, we interpreted the findings so that the intensity they felt about the discussion, or in just being there according to different conditions of sound sources, is the intensity that of general presence. The presence here, to some extent, can be grasped as in the example of the virtual auditory environment where there is no visual feedback available for the hearer (Västfjäll, 2003; Freeman et al., 2001). Moreover, we have created an environment where the sources are portable as in the experiment studying the detection of direction (Konishi, 1993). Beyond, by constructing our first scale we did lean over the dissimilarity of the fourth item of the scale through which we aimed to measure, say, a different type of presence and that is the involvement. The question of involvement showed that there was a significant difference between three direction conditions of the sound sources. What was measured there is more like a reflexive movement between the intensity of the discussion and the representation of that intensity to one's self from a more emotional base. Different from the interpretations of the first scale that we made where the responses accounts for a general intensity of the discussion, here in the fourth

question, we interpreted the data of how they felt about the intensity. As shown in the pleasantness dimension of the second scale where there is a marginally significant difference of females compared to males indifferent of direction conditions, to some extent, we may suggest that unpleasantness have a relation with intensity in that reflexive manner where the participants become avoidant of the discussion. Significant results of how participants react to discussion and how they relate it to themselves, by for instance escaping from it, can be more meaningful when we state that along the experiment a sense of presence has always been claimed. That presence has its relation to intensity in two ways, one of which is an intensity of the discussion in relation to activation in a general manner, and the other is an intensity of the discussion in relation to where a reflexive movement takes place. To go beyond the experiment that we conducted, at the very basic state, we should take account of constituting new levels of presences by manipulating the places of the sources in a more dynamic way, changing the quality of the sources, and playing around with the content of the sound. New levels will come with the new traits, and unexpected responses that suggests new clarifications of the notion presence.

Using a pair of stereo speakers strengthened current study in such a way that actuality of the discussion was enabled. Sound sources were the factors of creating virtual environment so that using developed stereo sound systems give the way of measuring the presence (Västfjäll, 2003). Thus, it has been observed that both emotional reactions and sense of presence is obtained due to their power of representing a real auditory environment. For in-

stance, three blindfolded participants reported that they felt as if there were present in a discussion and one blindfolded participant thought that there are real persons who are discussing with microphones in the room. While participants were attending to the discussion, we observed their responses such as facial expressions, clapping their hands and gestures which made us think they felt the actuality of discussion and affected by it.

Future research can code these responses in terms of emotional reaction and perceived intensity instead of scales. The questionnaire we generated can be developed by adding more questions to strengthen the idea of involvement in it as we found a direction effect on the fourth question that is about involvement. Adding a question such as “Do you acknowledge female discourse or male discourses to be right?” can be helpful because choosing a part can be understood as involvement to the discussion. Moreover, the sample size of the current study is caused a limitation to our findings. With a larger sample size, we predict that we can find more powerful results. Current study served the field as it reflects important results about auditory spatial arrangements.

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Emotional Valence and Memory: Effect of Verbal Stimuli with Emotional Valence on Working Memory Performance

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How does the emotional valence of a word affect working memory performance? There is contradictory evidence on whether emotional words impair or facilitate working memory performance. To clarify this issue, 89 native Turkish-speakers from Koç University, who are between the ages 18 and 24 ($M=20.93$, $SD=1.30$) were presented with a wordlist containing 10 positive, 10 negative and 10 neutral words and asked to recall them. Then, they were given a scale to assess their current mood. 3x3x2 Mixed ANOVA results showed that words with emotional valence are remembered more than neutral ones. We found that among words with different valence values, words with negative valence were remembered significantly more than the words with neutral and positive valence values. There was no significant effect of current mood or sex of the participants on their recall rate. No emotion-dependent differences in false alarm rates were found. These results demonstrate that negative valence of verbal stimuli has a facilitating effect on working memory performance regardless of the current mood or sex.

Keywords: emotional valence, working memory, current mood

What is the relationship between emotion and memory? Do we tend to remember emotional information more or does emotion interfere with our memory performance? Do we remember more unpleasant information better than pleasant information? By considering these questions, previous studies tried to examine the relation between emotion and memory; however, the direction of this relation remains a controversial topic. Galindo, Fraga, Machinskaya, Solovieva and Mangan (2015) found that pictures with neutral valence were remembered more compared to pictures with negative valence ratings. On the other hand, Adelman and Estes (2013) found that words with negative and positive valence were remembered more than neutral ones. However, Kesinger and Corkin (2013) claimed that the effect of emotional valence on working memory (WM) performance is visible only with visual content, but not with verbal content.

There is also very little research on how emotional verbal content can affect working memory performance. In this paper, we aim to clarify the controversy about enhancement and hindrance affects while using emotional verbal content.

Valence and arousal effects on memory performance

Affective information is categorized according to its two dimensions: valence and arousal (Russell, 1980). The valence dimension identifies between the pleasant (positive valence) and unpleasant (negative valence) cognitive states. The arousal dimension changes between arousal (high arousal) and rest (low arousal) states of human cognition. In discussion of effects of valence on memory performance, some researchers focused on how arousal enhanced memory for emotional stimuli independent from the valence effects (Choi et al., 2013). Studies that con-

sidered effects of both valence and arousal dimensions on memory (Kessinger & Corkin, 2003) suggested that arousal's effects on memory performance are greater than the effect of valence, and noted that valence did not have a significant effect on its own. On the other hand, in their study Adelman and Estes (2013) argued that regardless of the arousal level, words with negative and positive valence were remembered more than neutral words. As the valence became more extreme, thus higher valence for positive and lower valence for negative words, the memory accuracy increased. Studies investigating interference in verbal working memory found that interference was dependent on valence of the stimuli more than the arousal level of the stimuli (Levens & Phelps, 2008). Galindo et al. (2015) argued that while emotional stimuli decrease memory performance, the level of hindrance differed between valence dimensions of pictures. There is an ongoing controversy in the literature regarding the effects of valence on memory performance. In our paper, we aim to further resolve this controversy and find out whether words with different valence dimensions have varying effects on working memory enhancement independent of the arousal effects. We used the ANEW battery developed by Bradley and Lang (1999) to choose the neutral, negative and positive valence words we used in our study.

Hindrance vs. enhancement effects of emotional stimuli on working memory performance

Some memory studies claimed that attention demands of emotionally arousing stimuli and stimuli with high valences interfere with the storage function of working memory. On the other hand, some have provided evidence for the enhancement effects of emotional stimuli on memory performance. Gonzales, Lopez, Gomez, Ramos and Sequeria (2015) examined that positive valence emotional stimuli lead to higher accuracy in face recogni-

tion tasks than neutral stimuli. Although their initial hypothesis shows that they were expecting interference in the visuospatial sketchpad during attention processing of emotional stimuli as they anticipated WM resources to be shared between storage and processing. Another account that supports this argument was Lindström and Bohlin's study (2011), according to their findings; both positive and negative valence words have facilitated memory performance as pictures with emotional valence were recognized more accurately than neutral pictures. However, when Galindo and colleagues (2015) presented participants with neutral and negative pictures, they found that accuracy rate for pictures with negative valence were lower while the reaction time was longer. While accuracy rate for pictures with neutral valences were higher and reaction time was shorter. Another research compared working memory and long-term memory enhancement of verbal stimuli (Kensinger & Corkin, 2013) and found that while long-term memory performance was positively affected, there was no effect of emotional content on working memory accuracy and reaction time. In our research, we aim to uncover whether –during the processing of emotional verbal stimuli– the recall performance of working memory will be improved or hindered. And whether this improvement or hindrance varies in different levels of emotionally valence verbal stimuli of neutral, negative and positive words.

Working memory for verbal and visual stimuli

Working memory is composed of three main systems (Baddeley, 2012): central executive and two slave systems of visuospatial sketchpad and phonological loop. While there is no consensus on facilitative and hindrance effects of emotional content on working memory previous research has focused mainly on the recall and recognition of visual stimuli rather the verbal stimuli. Central executive

facilitates attentional focus, storage and decision making in the WM, phonological loop rehearses and stores verbal information, while visuospatial sketchpad is responsible for maintaining the visual information in the WM (Baddeley, 2012). There has been extensive research on mechanisms of visuospatial sketchpad. Research by Gonzales et al. (2015) show that emotion facilitates sensory verbal processing and attention mechanisms in visuospatial WM; thus, happy faces are remembered more accurately compared to neutral faces. Another research by Galindo et al. (2015) also highlighted the effects of emotional visual content on accuracy and recall rate of WM. In our study, we intend to contribute to the literature by investigating whether phonological loop's storage and rehearsal mechanisms are hindered or improved by words with emotional valence.

Effect of mood on memory performance

In previous research the connection between the mood states and memory performance is focused mainly on depression and how it affects working memory. Research conducted by Joorman and Gotlib (2008) shows that clinically depressed participants showed more intrusion errors regarding negative material. Thus, the previous research did not necessarily analyze how current mood states and verbal content with emotional valence affect recall. They mainly focused on how working memory performance is hindered by negative stimuli for patients with depressive disorder. Similarly, there is not much research on how different mood states varying from positive to negative affect working memory performance. In our research, we aim to uncover how the different current mood states affect recall rate of words with emotional valence.

The present study

In the present study, we compare recall rate of words with neutral, negative and positive valences in a working

memory task to examine whether words with emotional valence are recalled more than neutral words. Based on the literature about the effect of valence on memory facilitation, we wonder whether words with different valence dimensions have varying effects on working memory enhancement, whether the current mood state of participants affected the words they remembered and if there is a correlation between the current mood of participants and the valence of the words remembered. We hypothesized that working memory performance of words with negative valence will be enhanced in terms of recall rate in a verbal recall task. On the other hand, we expected positive and neutral stimuli to have lower recall rate compared to negative stimuli. We also expected the participants with positive mood state to remember more in the recall task and that the words they remembered would be positive valence words.

Method

Participants

The sample consists of 89 native Turkish-speakers from Koç University, and 48 of them were female while 41 of them were male. Participants were between the ages 18 and 24 ($M=20.93$, $SD=1.30$). Our exclusion criteria were being in a depression period or having a prior depression history. The participants were either volunteers or registered in the experiment to earn extra credit for Introduction to Psychology (PSYC 100) course. All our participants were given written consent form and were informed about all their rights and the purpose of the research before the experiment. The ethics committee of the Koç University previously approved the study.

Materials

The emotionally valence words were presented to the participants in a silent studying room in the library using a slide show. The presentation consisted of

30 words with different emotional valences (10 positive, 10 neutral, 10 negative) presented to a white background with each word appearing on individual slides. The words were situated horizontally on the screen in 60 point Calibri font. We were able to find a comprehensive list of the “Affective Norms for English Words” with their affective ratings to benefit from this list. However, as words in foreign language may lack the emotional associations the words in one’s native language has (Anooshian & Hertel, 1994) we decided to use Turkish versions of these words as the native language of our participants is Turkish. We used words with valences lower than 2 as our negative words, neutral words had valences that were between 5 and 6, and valences for positive words were between 7.50 and 9. All slides appeared on the screen for two-seconds and the sequences of the slides were randomized in every trial to counteract the primacy and the recency effects of memory recall. After the slide show, participants were provided with an empty paper and a pen to note down the words they remembered. Their answers were recorded with an iPhone voice memos app with their participant numbers. After the collection of the paper, participants were given a demographics questionnaire including a mood scale for them to determine their current mood state between the values of 1 to 7 (1 being low current mood and 7 being high current mood). The demographic questionnaire included participants’ name, their sex, age, birthdate and their native language.

Procedure

To start the experiment, the experimenter explained that the study is about the interaction between memory and the phonological loop, and asked the participant whether they want to attend the experiment. If the person accepted to participate to the study, two informed consent forms were given for the student to sign.

The experiment had two compo-

nents for the participants. All experiments were done in quite settings adequate for the participant to concentrate and in one trial maximum of 2 participants participated at the same time. After signing the informed consent, participants were given instructions for the viewing task and asked to pay attention to the words and were said that when the slide show is over, they will be provided with the materials to write and vocalize the words they remembered. Participants were then asked to write down the words they recalled from the task. They were given as much time as they wanted to complete this task. After participants wrote what they remembered and vocalized them, they were given the current mood scale and demographics questionnaire. At the end of the experiment, the experimenter debriefed participants about the real purpose of the research, which was measuring the recall rate of emotional valence words.

In order to determine our experiment’s results, we looked at the words each participant remembered, and we categorized these words into neutral, positive and negative words by looking at their emotional valence ratings. The recall rate of words was measured for each participant. Some of the participants remembered words that were not in our wordlist. We called these words “false alarm words”, and then we categorized these false alarms by their emotional valence using the same rating criteria. We also looked at all participants’ mood scale and recorded them into our output. In conclusion, our SPSS output includes the number of words that participants remembered, their sex, their mood scale, id numbers and false alarm words.

Results

In our experiment, we tried to clarify the controversy in the literature about the relationship between emotional valence and working memory performance. In order to investigate the relationship between memory and emotional valence, we con-

ducted 3x2x2 mixed ANOVA with between subject variables sex and mood, and within subject variable of emotional valence of words. Our dependent variable is the number of words accurately recalled (i.e., recall rate). The test of within subject effects showed that the main effect of emotional valence of words is statistically significant, $F(2,174)=3.814$, $p=0.024$. Thus, words' emotional valences have a significant effect on recall rate. Pairwise comparison results showed that the recall rate of negative words ($M=4.19$, $SD=1.522$) is significantly higher ($p=0.046$) than the recall rate of positive words ($M=3.64$, $SD=1.440$). However, the recall rate of words with neutral valences was not significantly different than the recall rate of words with positive ($MD=0.149$, $SE=0.211$) or negative ($MD=0.400$, $SE=0.182$) valences. Furthermore, our analysis indicates that there is no main effect of sex on recall rate of the words, $F(1,87)=.696$, $p=.406$.

We divided participants' mood scores into two groups of low (bad) mood and high (good) mood, since the distribution of mood scores of participants were negatively skewed. There were 36 participants in the low current mood group (mood scale scores: 1 to 4.9), and 53 participants in the high current mood group (mood scale scores: 5 to 7). Our mixed ANOVA results showed that current mood does not have a main effect on the recall rate, $F(1,87)=.0227$, $p=.635$. Thus, mood does not facilitate or hinder the one's recall performance.

There was not an interaction between emotional valence and sex, $F(2,174)=.141$, $p=.868$. Thus, the valence of recalled words did not vary across the sex of the participants. Moreover, there was also not a significant interaction between emotional valence of words and current mood, $F(1,174)=0.295$, $p=0.745$, indicating that the word valences did not vary across different moods of the partici-

pants. There were false alarms in the recall process, in which participants reported words that did not exist in the list they studied. 19 participants engaged in positive false alarm, 15 of them engaged in negative false alarm and 19 of the participants engaged in neutral false alarm.

Discussion

This study aims to clarify the controversy in the literature about the relationship between emotional valence and working memory performance, and to go beyond the emotional visual content by using verbal materials. In order to see whether or not positive and negative emotional valence of words (among positive, negative, neutral) enhances working memory performance, we asked participants to recall the word list that contains 10 neutral, 10 negative and 10 positive words presented in a random manner. Then, we gave a current mood scale to measure the current mood of the participants. We expected a positive correlation between being in a good mood and the recall rate of words with positive valence and a positive correlation between being in a bad mood. Overall, results suggested that emotional valence of words affects working memory performance. We found that: (1) there was a main effect of valence on recall; (2) negative words are remembered more than positive ones; (3) there is not a main effect of mood and there is no interaction between the current mood of participants and their recall rate of emotional words; and (4) there is not a main effect of sex on recall rate.

There were contradictory accounts as Galindo et al. (2015) suggested that neutral pictures were remembered more than negative ones. However, the current study showed that negative words are remembered more compared to neutral words, and this finding raised several questions. What might be the reason for this contradiction? One possible explanation is that our design was different than

the mentioned study. There has been little research on how emotional verbal content can affect working memory performance as previous studies predominantly focused on visual emotional content such as pictures or videos instead of words. Thus, they looked at working memory performance in terms of visuospatial sketchpad; whereas, we looked at performance of another slave system, the phonological loop. In this manner, it might be the case that the effect of emotional valence on working memory performance differs based on the verbal and visual nature of the material used since different materials appeal to different components of the working memory. Thus, whether the content is visual or verbal might be significant for understanding the relationship between emotional valence and working memory performance.

Another fundamental point is the superiority of negative words among positively valence words in terms of recall rate. This finding also differs from what previous researches suggested. Kensinger and Corkin (2015) emphasized that negative content interferes with working memory tasks as it biases attention. Thus, negative valence hinders working memory performance. However, results of our study showed that negative words are remembered significantly more than positive and neutral words. This contradiction might be as a result of our design. We measured recall rate in the memory task as an indicator of working memory performance; however, we did not look at the reaction times during recall for words with different valences. We also emphasized to our participants the accuracy of the words they recalled rather than the time they spend for recalling the words. In this sense, we could not figure out how much time participants spent for each category of words. They might have spent more time for negative words while they remembered others faster. Future studies should consider measuring reaction times together with accuracy, which in return could provide a better un-

derstanding of the relationship between emotional valence and working memory performance.

Although there is evidence suggesting that mood can impair one's working memory (Martin & Kerns, 2011), there is still no consensus about the effect of mood on cognitive control including working memory capacity in the literature. On this note, in this study, we aimed to examine whether the type of words remembered with respect to their emotional valence depends on current mood of the participants. Our results showed that there is no statistically significant interaction between current mood of participants and their recall rate of emotional words. Thus, people who had high moods did not remember words with positive and high valences more; likewise, people who had low moods did not remember words with negative and low valences more. What might be the reason for the discrepancy between our result and previous research that found positive mood as impairing working memory capacity? One possible explanation is that previous research manipulates emotional arousal rather than valence. Our result might seem like it is violating our expectation; however, it provides us a clearer understanding. Regardless of how participants feel at that moment, they remembered negative words more. Moreover, sex of participants does not have a main effect on their recall rate; therefore, participants' working memory performance is related solely to the emotional valence of words.

Another limitation in our research is the fact that we had to translate the Affective Norms for English Words (ANEW) battery to Turkish since our participants were native Turkish speakers and there is not a comprehensive Turkish word list with valence and arousal ratings. Thus, we cannot be sure if the words kept their previously assigned valence ratings during the translation. Although this limitation prevents us to know the exact valence values of the Turkish words used in the study, we hope that this research will pioneer future

valence and arousal measurement research for Turkish words.

Finally, we analyzed false alarm rates, which are the words that were written by participants when in fact they were not in the presented word list. According to this analysis, it is seen that people tend to write words that are semantically related to the ones presented in the list. This finding is in line with Roediger & Mcdermott's study (1995) in which the "false alarm words" produced by the participants were semantically associated with those on the list. We also found that false alarms were either synonyms of original words in the list or other words that are associated to original ones based on their meaning. However false alarm words did not differ in their valence ratings.

In conclusion, this study showed that emotional valence enhances working memory in terms of recalled words, and the relationship between emotion and working memory differs based on which component of the working memory is processed. Words with negative valences are recalled significantly more according to the results of the study. Current mood and gender of the participants did not have an impact on this relationship. These findings might clarify the ongoing controversy about the role of emotions and valence on working memory performance, and pioneer to further research that can use both accuracy and reaction time.

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Self-Esteem and Financial Risk Taking

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With increasing financial alternatives in modern societies, people have difficulty managing their money. This research looks at the psychological basis of this by testing the hypothesis that university students with high self-esteem are more likely to prefer high-risk options in financial risk taking. The purpose of this research is to explore the relation between self-esteem and financial risk taking. Methods of this research are investigating the sources of Koç University Database, and conducting an online quasi-experiment, the participant pool of which consists of 65 participants from various universities in Turkey. Turkish adaptation of Rosenberg Self-esteem Scale is followed by three tasks inspired by the literature review. The participants were asked to make choices, which show their tendency of risk taking in financial contexts. The data provided by three different tasks shows different results, with two not indicating a significant relation, and the Dollar Auction supporting the hypothesis. Although the research controls for possible confounds, the statistical data fails to support the hypothesis in a consistent manner, but lays a ground to expand and question what other factors might affect the decision-making processes.

Keywords: self-esteem, risk taking, finance

Throughout the years economists assumed that people decide on financial situations in a rational, mathematically logical manner, and construct their economic theories accordingly, but behavioral economists led by Daniel Kahneman and Psychology in general begs to differ by adding many motives and personal characteristics that influence people's judgments, preventing people from finding the ideal choice. For example, the use of cognitive heuristics, or mental shortcuts in everyday life makes people more likely to settle on irrational decisions. One of the possible underlying motivations for a person's financial decision-making process is the level of self-esteem. How does self-esteem play a role in economic choices of the modern

society? This research is motivated to provide a clear answer in response to the inconsistent results provided by prior research.

Self-esteem levels are predicted to be either directly or indirectly influencing the financial risk taking processes of people. Cavallo and colleagues (2012) suggest that people with higher self-esteem look for goals to achieve, whereas people with low self-esteem try to avoid failure. The underlying mechanism is the self-regulatory strategies that vary for people that have different self-esteem levels. Furthermore, the paper explains how participants with low self-esteem are more conservative financially, due to their efforts to refrain from failure (Cavallo et al., 2012).

Although self-esteem is seen as a pre-existent and a fixed aspect that psychologists are only able to quasi-experiment on, Zhang and Baumeister (2006), decides to manipulate the participants' egotism, which is the inclination to have and maintain a positive view about oneself, and make them go through various risk taking tasks. They use numerous testing methods, and one of them is the Dollar Auction task, which symbolizes the financial aspect of the risk taking research. The results show that there is indeed a relation between egotism and our decision-making processes, decreased egotism results in a higher investment and a higher loss compared to the people that didn't have any negative manipulation of their egotism.

In contrast to the articles that create a direct relation between self-esteem and financial risk taking, Duclos and colleagues (2014) suggest that social exclusion leads people to take riskier choices during the process of seeking acceptance by a group. The fact that they try to be accepted to preserve their self-esteem can be seen as another experimentation attempt of self-esteem, through manipulation of the participants.

Moreover, the researches of Jiuhua and colleagues (2013) use Dollar Auction task as well as other methods, yet they see self-esteem as already existent and instead of trying to manipulate it, they only test it through the Rosenberg Self-esteem Scale. Unlike any other research, Jiuhua and colleagues (2013) argue that people with average self-esteem are the ones that are most likely to take risks.

On the other hand, some researchers claim that the financial risk taking should be measured by neuroscientific data. For instance, Yang and colleagues (2010) follow the neuroscientific analysis

steps, but it fails to observe any relation between self-esteem and risk taking tendencies. Nevertheless, they still suggest that emotional signals are more active for a person with higher self-esteem during the risk taking process.

To summarize, there are multiple operationalizations of self-esteem and of financial risk taking within prior research. This instigates a pile of vague answers and lack of conclusion due to the presence of equivocal results that are not quite testing the same aspect of financial risk taking. The most credible tests are done on bigger samples and they suggest a positive relation between self-esteem and financial risk taking. Therefore, this research focuses on the effect of self-esteem on financial risk taking tendencies, and argues that the higher self-esteemed university students have higher tendency of risk taking in financial decision making processes.

Method

Participants

The research participants were limited to 65 Students from Turkish universities. Therefore, the age interval varied from 18 to 26 years ($M = 20.58$, $SD = 1.87$). The participants consisted of volunteers (36 females and 29 males), and the sample was gathered through snowball sampling. The participants followed the instructions and answered certain questions through a web page.

Materials

First of all, to get a self-esteem score for the participants, the Turkish adaptation of the Rosenberg Self-esteem Scale was used. The Self-esteem Scale was followed by questions to determine

the socioeconomic status and other general information to be obtained such as gender and age.

To identify the tendency of risk taking, three different financial risk-taking tasks were included in the materials of the research. The first task was asking the participants to choose between two options, winning 500 TL with an 80% chance, or winning 75 TL with a 100% chance. The second task is the Dollar Auction that was also used in the research by Zhang & Baumeister, and originally created by Martin Shubik. The task is to bid on a 20 TL bill, it is a competition between the virtual opponent and the participant. The winner gets 20 TL and pays the amount that they bet, the tricky part is that the runner up must pay their latest bid, yet receive no prize whatsoever. The third task involves the dictator game, which was initially developed by Kahneman. In the task, the participant has to offer an amount from 0 to 10 TL to their opponent. If the opponent approves the offer, they supposedly share the money, but if the opponent refuses the offer, then everyone is left empty handed.

The web page, in which the participants answered the questions through, was created by Ege Çarkoğlu, an undergraduate Computer Engineering student in Koç University. The virtual opponent in the Dollar Auction task was also designed by his expertise.

Procedure

The participants that enter the website for this research were asked to sign the consent form, later on they answered the questions of Rosenberg Self-Esteem Scale that was translated to

Turkish by Çuhadaroğlu. The Self-Esteem Scale was followed by the questions that aim to find out about personal background information and some indicators of socioeconomic status. At the final stage, three tasks that are explained in detail in the materials section were presented to the participants for determining their tendency for financial risk taking.

Results

The research data constitutes of three different results from the three tasks explained in the materials section in detail. Therefore the results section explains how the results for the first task were analyzed using Chi-Squared tests. The results of the second and third tasks were analyzed using Two-Way Univariate Analysis of Variance individually. The alpha level for all the conducted tests was 0.05.

First of all, the Self-Esteem Scale was used to generate two groups of self-esteem, low self-esteemed participants have a score of 1 to 4.5 in our sample ($M = 2.23$, $SD = 0.91$) and high self-esteemed participants have a score of 0 to 1 ($M = 1.32$, $SD = 0.98$) from the Rosenberg Scale. This cut off point is determined by dividing the sample equally.

Since the dependent variable in the first task is categorical, Chi-Square Test of Independence was used for testing the initial hypothesis. The percentage of participants that are risk taking did not differ by self-esteem levels, $\chi^2(1, N = 65) = 0.003$, $p = .95$.

For the Dollar Auction task, the net profit the participant got was calculated and used as the dependent variable of the two-way ANOVA. Education levels of the participants' mother and father, and the

participants' scholarship status were added as covariates. The two-way ANOVA showed that the differences in net profits of low self-esteem participants ($n = 25$, $M = 1.28$, $SD = 11.87$), and high self-esteem participants ($n = 35$, $M = 2.19$, $SD = 12.29$), were statistically significant, $F(4,55) = 4.87$, $p = .002$, $\eta^2 = .263$.

For the Dictator Game task, a two-way ANOVA was conducted. Education levels of the participants' mother and father, and the participants' sex and scholarship status were added as covariates. The two-way ANOVA showed that the differences in net profits of low self-esteem participants ($n = 24$, $M = 4.94$, $SD = 1.42$), and high self-esteem participants ($n = 32$, $M = 5.38$, $SD = 1.74$), were statistically insignificant, $F(5,50) = 2.03$, $p = .090$, $\eta^2 = .169$.

Discussion

Although the main focus of the paper was to clarify the relation between self-esteem and financial risk taking tendencies of university students, by using a comprehensive battery that includes tasks from different prior experimentations, there is still not a clear answer to the research question. The initial hypothesis that high level of self-esteem of a university student would be an indicator of high tendency of financial risk taking failed to be supported by the first and the third task. But with the second task, we were able to see a significant difference of financial risk taking between the low and high self-esteem participants. According to the results of the second task, participants with higher self-esteem got a higher average of net profit, meaning that they bid much higher than the participants with lower

self-esteem, which shows higher financial risk taking tendency.

The results of the risky decision task and the dictators game is consistent with the research by Yang et al. (2010), which also did not observe any relation between self-esteem levels and risk taking tendencies in financial situations. On the other hand, the significant relation that is found in the Dollar Auction contradicts the research by Jiuhoa et al. (2013), which also uses the Dollar Auction and indicates that people with average self-esteem have the highest possibility to take risks. This may be due to the fact that the research conducted for this paper focused on university students, and different demographics might indicate an alternate variance due to occupation. Furthermore, although Zhang and Baumeister (2006) manipulated egotism instead of using self-esteem as a pre-existent factor, the results of the Dollar Auction of this study is still similar to their study. The study by Cavallo and colleagues (2012) suggests that people with high self-esteem are less cautious and not conservative as people with lower self-esteem levels. This may be a possible reason for the relation we find on the dollar auction game. The mechanism behind this can be explained by higher self-esteem leading to less self-doubt and decreased self-regulation, resulted in higher risk taking.

The fact that the research does not reach its initial aim in two of the tasks tested is most likely due to the scope of the research, and how limited it is compared to the prior research in terms of sample size. Furthermore, although some aspects of socioeconomic status were controlled throughout the data analysis procedure, due to the extreme amounts of missing data in monthly income of the participants, a

significant socioeconomic indicator was left out of the calculations, although the education level of the parents were partially compensating for the missing data in terms of monetary status of participants.

If more participants had attended the experiment, the research could have achieved more reliable results. Therefore, further research should be conducted with a larger scale of a sample. To further analyze the tendency of financial risks and its relation to self-esteem, the sample can include other sub-groups such as older age intervals, to compare the variances with the university students' results. Another idea could be to make a longitudinal research to see the developmental course of the relationship between financial risk taking and self-esteem since the relation might differ in distinct developmental stages including adolescence and adulthood.

Even though the uncertainty persists after this research, more in depth work could be performed. The determination of the relation between self-esteem and risk taking tendencies can be further used for therapeutic purposes for people that suffer from gambling addiction. Major losses in the stock exchange market also seem to be causing depression and even leading to suicide. So, the connection between self-esteem, decision-making processes and the coping mechanisms at times of failure can be researched to approach such patients accordingly. Moreover, consumer behavior and neuromarketing are fields that can further research the topic by collecting brain activity data, and using a larger and more representative data. For instance, neuromarketing might focus on the neurological and biological responses of the participants and connect it to marketing strategies in order to come up with

new theories. Additionally, the modern behavioral economics studies can make use of the relation between self-esteem and risk taking probability by using this information as a tool to explain the illogical choices made by individuals, or to update certain utility theories to improve their formulation of behavioral economics. Besides, the findings can be used to improve therapy methods of troubled individuals that experience issues in life due to an extreme tendency of financial risk taking, as gambling problems, excessive consumption habits, debt issues or such other problems.

In conclusion, the hypothesis that higher self-esteem in university students indicates higher tendency of financial risk taking was only supported by the Dollar – Auction task. Thus, the present study failed to find a significant effect in the risky decision task and the dictators game replication. The relation between self-esteem and financial risk taking tendency remains open to further research to gain a consistent answer to the question.

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Phone Use During Dyadic Conversations Decrease Perceived Politeness Despite Social Attraction

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The effect of phone use in a dyadic conversation between a person and an unacquainted other on the perceived attentiveness and politeness of the conversation partner was investigated in a study with 30 participants (15 females, 15 males). The experimental study was designed with two conditions; one of which included the phone use by the unacquainted other during the conversation while the other did not. As part of the experiment, participants were asked to engage in a task, a 10-minute conversation to get to know an unacquainted other, followed by a questionnaire that rated their perceived politeness, attentiveness and social attraction towards their conversation partner. Results indicated that even though the effect of phone use on one's perceived politeness and attentiveness was significant, when controlled for social attraction, the effect of phone use was only significant for perceived politeness. It was concluded that phone use during a dyadic conversation with an unacquainted other resulted in lower perceived politeness regardless of social attraction. Future research must focus on identifying social attraction's role in perceived attentiveness, in the context of active phone use during an offline dyadic conversation.

Keywords: phone use, perceived politeness, perceived social attraction

With the rise of the new media and technological advances, the social rules of the society have changed. Smartphones encourage user to be online at all times; an observational study by Humphreys (2005) showed that new types of social interactions and public power dynamics are formed with this new technology. One of the effects of mobile phones was named to be “phubbing”, a term introduced into the literature to describe an individual engaging with their mobile phone, and evading interpersonal communication (Roberts & David, 2016). The most significant determinant of phubbing was found to be mobile phone addiction (Karadağ et al., 2015).

This study also revealed that mobile messaging during a conversation results in a lack of nonverbal attentive behaviour, which might create a negative impression on the conversation partner.

The research on the negative effect of mobile messaging on social interactions is divided into three areas: social interactions with unacquainted others, social interactions in relationships and social interactions in the workplace (Vanden Abeele et al., 2016). The fact that many people in the work environment, constantly use their mobile phones, and engage in multiple conversations at once, created the term “multicommunicating”, which is suggested

to be the first step in the incivility spiral (Cameron & Webster, 2011). From a relational aspect, studies focused on the question of how the use of mobile phones affect relational quality, with regards to following internalized or societal norms. It is found that individuals who follow their internalized norms reflect more relational quality than individuals who follow societal norms when there is same amount of phone use by their partner; and individuals who follow their internalized norms reported less mobile phone interference by their partner (Hall et al., 2014). Another study investigating the relationship between partner phubbing- mobile phone use in the presence of the partner- and relational satisfaction found that this relationship is mediated by disagreements over phone use, which was reported to be observed more frequently among individuals with anxious attachment styles (Roberts & David, 2016).

Despite the availability of fewer empirical evidence compared to the relational aspects of phone use, the research on unacquainted others is promising. A study by Misra and colleagues (2006) showed that the mere existence of one's phone during conversation resulted in lower ratings of the conversation quality and the conversation partner's perceived empathetic concern. Another study found that mobile messaging had a negative effect on politeness and attentiveness perceived between unacquainted others (Vanden Abeele et al., 2016).

As mobile messaging results in a lack of non-verbal attentive behaviour (Humphreys, 2005), and as unacquainted others form impressions based on their evaluation of each other's behaviours and attitudes, such as attentiveness and politeness, it is only logical that a lack of nonverbal atten-

tive behaviour, in the form of mobile messaging, results in an impression to be negatively shaped. With an experimental design that has two groups, the difference between impressions, measured with perceived attentiveness and politeness, of individuals who use their phones during a conversation and those who don't can be studied. In this study, the information that is exchanged between the unacquainted others was controlled, making mobile phone use the sole difference between two condition, in order to predict a significant effect. During an offline conversation with another individual, the lack of attentive behavior, due to the phone use, was expected to negatively influence one's impression of the other. This influence was anticipated to be seen clearly when one is forming a first impression, in order to create an impression that is solely based on the situation. Therefore, in this research, lower scores on perceived politeness and attentiveness of the conversation partner were expected from individuals who had a dyadic conversation with an unacquainted other who used their mobile phone during the conversation.

Method

Participants

For the experiment, participants from Koç University, Boğaziçi University and Istanbul University were asked to join. No incentives were presented to the participants upon acceptance to participate in the study. 30 participants were recruited, of which 15 were male and 15 were female. All 30 participants were recorded to have Turkish as their native tongue. Sex of the participants was balanced, to control for any effect that sex might have on the experiment. There were 15 participants in the control condition (7 females and 8 males)

and 15 participants in the experimental, “phone use”, condition (8 females and 7 males). 4 participants were employees in these universities and the other 26 were students (of which 2 were PhD students, and 24 were undergraduates). On average, the participants were 23.23 ($SD=5.99$) years old.

Materials

For measuring the constructs, perceived attentiveness and politeness, and the covariate social attraction, a 7-point Likert scale survey with 11 items, was given to the participants at the end of the experiment. Items measuring perceived attentiveness were taken from the Communicator Style Measure by Norton (1978). For perceived politeness, items that were developed by Trees and Manusov (1998) were used, and items measuring social attraction were taken from the study of Weisband and Atwater (1999), measuring likeability. All items in the survey were used by Vanden Abeele et al. (2016) in a similar research. Items were ranked from 1 (strongly disagree) to 7 (strongly agree).

Attentiveness. For measuring perceived attentiveness, four items were taken from the Communicator Style Measure by Norton (1978), used by Vanden Abeele et al. before, in their 2016 experiment. The items were as follows: “My conversation partner seemed involved with the conversation”, “My conversation partner behaved animated during the conversation”, “My conversation partner seemed to listen carefully”, and “My conversation partner seemed interested in the emotions and needs of others”. The scale items resulted in an adequate level of consistency with regards to reliability, with a Cronbach alpha of 0.67.

Politeness. The three items used for measuring perceived politeness were the items found in the study of Trees and Manusov (1998), used by Vanden Abeele et al. (2016) before in a study with the same measurement intentions. The items were as follows: “My conversation partner behaved inappropriate”, “My conversation partner behaved polite”, and “My conversation partner seems like a decent person”. Items showed an adequate level of consistency with regards to reliability, with a Cronbach alpha of 0.69.

Social Attraction. This concept was defined as the likeability of the conversation partner. To control for its effects, social attraction was also measured, with three items from Weisband and Atwater (1999). The items were: “I like my conversation partner”, “I dislike my conversation partner”, and “I would like to see my conversation partner again”. The items were used by Vanden Abeele et al. (2016) before for a similar research.

Procedure

Using an experimental method, a two-group, between-subjects design was used to measure perceived attentiveness and perceived politeness. The experiment had two conditions: the control condition (no phone use during conversation) and the experimental condition (phone use during conversation). After agreeing to participate in the experiment and signing the consent form, the participants were asked to engage in a conversation with an individual they did not know before, a confederate whom the participant thought to be another participant. The confederate was female and 21 years old. The objective of the task, which was getting acquainted, was clearly stated for the participant.

A 10-minute conversation time was set for the participant and the confederate, which is considered appropriate for an acquaintance task (Sunnafrank & Ramirez, 2004). In the first 6 minutes, the confederate and the participant were asked to talk about themselves (their age, family of origin information, hobbies etc.) while the other listened and 3 minutes were given to each. The confederate always started the first three minutes, followed by the participant. A list of sex-neutral topics was given, to shape the conversation and control for the information given. All the participants gave the same type of information: age, school, family of origin information, pets, hobbies, favourite films and TV shows, dishes and countries they have visited. In the last four minutes, the dyads asked and answered questions about each other (2 minutes each, starting with the confederate).

In the “phone use” condition, the confederate took their phone in their hands, read a message and replied to it at minutes 3.45, 5.15 (while listening to the participant) and 7 (during question time). In the “no phone use” condition, however, no phone was at sight; the confederate never used a phone. There was no other major change regarding the behavior of the confederate.

After the acquaintance task, the individuals were separated to fill out a questionnaire about each other (only the participants completed the questionnaire about the confederate). The participants were informed that the questionnaire would not be shared with anybody, and asked to answer it as honestly as possible. The participants were thanked upon completion of questionnaire and a debriefing session was conducted. In the debriefing session, the actual identity of the confederate as a part

of the experiment is revealed, along with the manipulation that took place (the phone use). The actual objective of the experiment, which is the effect of phone use during a dyadic conversation between unacquainted others, is revealed to the participants. Any questions from the participants were entertained and answered.

Results

Separate independent t-tests were done to test the effect of phone use on perceived attentiveness and perceived politeness. Because social attraction was suspected to be a covariate, ANCOVAs were performed to control for any effect social attraction might have on perceived attentiveness or politeness. The hypothesis expected perceived attentiveness and perceived politeness to be higher when there was no phone use, compared to the phone use condition. The average perceived attentiveness was 5.67 ($SD = 0.91$), and the average perceived politeness was found to be 6.63 ($SD = 0.46$).

For perceived attentiveness, the t-test results indicate significant difference between perceived attentiveness of individuals who were in the “phone use” condition ($M = 5.27$, $SD = 0.93$) and perceived attentiveness of individuals in the “no phone use” condition ($M = 6.07$, $SD = 0.70$), $t(28) = -2.66$, $p = 0.01$. For perceived politeness, there was a significant difference between perceived politeness of individuals in the ‘phone use’ condition ($M = 6.42$, $SD = 0.53$) and individuals in the ‘no phone use’ condition ($M = 6.84$, $SD = 0.25$), $t(19.91) = -2.81$, $p = 0.01$. The results show that people who engage with their phones during a dyadic conversation are likely to be perceived as less attentive and polite, by an unacquainted other.

A one-way ANCOVA was conducted to determine if there is a statistically significant difference between phone use and no phone use during a dyadic conversation on perceived attentiveness, controlling for social attraction. The results indicate that there is no significant effect of phone use on perceived attentiveness after controlling for social attraction of the individual to their conversation partner, $F(1,27) = 1.49$, $p > .05$. A one-way ANCOVA was conducted to determine if there is a statistically significant difference between phone use and no phone use during a dyadic conversation on perceived politeness, controlling for social attraction. The results show that there is still a significant effect of phone use on perceived politeness after controlling for social attraction, $F(1,27) = 4.90$, $p < .05$.

Discussion

The study investigated if phone use had any significant effect on perceived attentiveness or politeness of an unacquainted other during a dyadic conversation. The results indicated that there is a significant negative effect of phone use on both perceived attentiveness and perceived politeness. To control for any effect of social attraction on attentiveness and/or politeness, social attraction variable was also measured, as no controlling for or balancing of the variable could be done during the experiment. Controlling for the effects of social attraction, no significant effect of phone use on perceived attentiveness was found, but a significant effect of phone use on perceived politeness remained.

Results supported half of the hypothesis that expected perceived politeness to decrease with phone use, and rejected the half of the hypothesis that expected per-

ceived attentiveness to decrease. The analysis showed that during an offline conversation with an unacquainted other, the use of mobile phones by the conversation partner negatively influences perceived politeness, but not perceived attentiveness. When controlling for social attraction between two people, the perceived attentiveness is the same whether one of them is using the phone or not, but when it comes to evaluating politeness, individuals perceive others who use their phone during the conversation as less polite. The lack of difference in perceived attentiveness when it comes to phone use could be, because the negative effect of the phone use on perceived attentiveness balanced out the positive effect of social attraction on the impression. It might be that individuals did find their partner less attentive when they were using their phone, but their social attraction to the conversation partner obstructed them.

Vanden Abeele and colleagues (2016) explored the effect of mobile messaging on social attraction, politeness and attentiveness as well, but the effect on social attraction was investigated separately. Their findings suggested that all three of the concepts were affected by mobile messaging. Adding to Vanden Abeele and colleagues' research, the findings of this study show that when social attraction and attentiveness paradigms are considered together, the significant effect of decreased perceived attentiveness disappears. The study yielded results that are parallel with Misra's (2016) research that claimed exposure to mobile phones during conversation affects perception of the individual towards their conversation partner.

A limitation for the research was matching same-sex partners for the conversations. Due to practical reasons and logis-

tics, only a female confederate was used and so male participants were matched with a different-sex confederate. Fortunately, any error due to this was minimized when controlling for social attraction, because the main reason to match same-sex individuals were to minimize the effect of social attraction. As controlling for participants' sexual preference and their social attraction preference was not possible, measuring social attraction and eliminating its effect statistically proved to be more effected.

The matter of convenience sampling was a major limitation for this research, as this was an experimental design with only two groups. Due to convenience sampling, upon agreement to participate, the participants were assigned to either the experimental or the control group. The experimenter knew which participants were assigned to which group; therefore the research had a single-blind design. Only the participants did not know which group they belonged to, or that there were multiple groups. Also, due to convenience sampling, individuals, both students and employees, were recruited from different universities. Gathering data from students that are attending different universities helped to create diversity and control for any effect being a Koç University student brought into the study. It has also allowed the results to be generalized to college students in Turkey. Although collecting data from different universities contributed to the generalizability of the study, including employees, created a disadvantage. The purpose of including employees was to create even more diversity in the subject pool. Unfortunately, not enough subjects participated in the study. Furthermore, the employees that were in the sample was all in the age range of 23 to 36, however, the

age range of the students was 18 to 23, creating a generational difference. As current technological advances affect generations differently, the difference in attitude towards mobile phone use might have created a generational effect. However, because there were only a few employees, excluding these subjects from the analysis showed no difference in the significance of the results.

Another limitation was with the confederates. Firstly, the confederates had to be informed about whether their conversation partner belongs to the experimental or the control condition in order to carry out the experiment. This knowledge might have resulted in a change in behavior, a certain bias for the confederates. Secondly, confederate reported to feel "uncomfortable" and "uneasy" during the experimental condition, while consciously looking at their phones instead of listening to the participant. This could have also created a bias in behavior of the confederates.

The Cronbach's alpha for each measurement was recorded to be lower than Vanden Abeele and colleagues' (2016) Cronbach alpha, who used the same measures for the same variable. This was due to cultural differences between evaluation of concepts attentiveness and politeness. If Turks, for instance, were less inclined to respond to a recoded question with lower scores than individuals in western cultures, then the recoded variable in the politeness scale might have decreased the reliability of the measure perceived politeness. Absence of a translation of the items might also be the reason for the lower reliability test scores. It might be the case that the items on the scales did not measure reliably. For these differences, the research can be considered culturally biased.

Lastly, the differences in attitude, which participants may have had, towards mobile messaging was a limitation. Due to time constraints, a pre-test that explored how participants perceived mobile phone usage during conversation was not conducted. Therefore, the tendency of the participants to react to mobile phone usage was not controlled. This difference in tendencies could be affecting the results found from the experiment.

Future research should test the effect of mobile messaging via a questionnaire that is proved to successfully measure the variable, in the context of the participants' culture. Future research should also investigate the role of social attraction in perceived attentiveness and politeness, regarding active phone use during a conversation with an unacquainted other. More replications and replication with exclusions must be made in order to strengthen the findings on the literature so far and to state the effect of phone use on our social interactions with confidence.

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An Elaborative Review on Imaginary Companions and its Possible Connection to Theory of Mind

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This paper is devoted to understand, review and reflect on the nature of imaginary companions regarding various characteristics of the phenomenon, yet the scope of the paper is more focused on the possible relationship between imaginary companions and theory of mind. To get a deeper sense of the phenomenon, firstly, the definition of imaginary companions and issues related to definition, such as the extent of age in the sphere of imaginary companions, and how cultural differences influence parents', teachers', and children's perspective on imaginary companions, will be explained. Although, the subject is attracting the psychologists recently, the area of imaginary companions has been a research of interest for many decades. Secondly, early studies will be discussed in terms of negative and positive sides of imaginary companions to understand the historical background of the phenomenon. Additionally, a connection between early studies and methodological issues will be made by criticizing several methodologies that had been used in the early research in the relevant area. Furthermore, recent studies that address the possible advantages of imaginary companions will be examined, that includes possible linguistic benefits. Then, the author will review the intersection of imaginary companions and theory of mind in a detailed manner. A connection between imaginary companions, theory of mind, and autism spectrum disorder will be made in line with the previous discussion. In conclusion, a proposal will be made that considers the possible intersection of imaginary companions and theory of mind along with the possible implications of the link between imaginary companions and autism, that is the interventions that can be implemented to diminish various impairment that individuals with autism have by training children to play with imaginary companions.

Keywords: imaginary companions, theory of mind, pretend play, autism spectrum disorder

Imaginary companion (IC) is a part of pretend play including the friendship or other interpersonal relationship that takes place in the imagination of an individual rather than physical reality in which a form of simulated social exchange exists and children perceive the imaginary companion as a separate entity (Harris, 2000; Trionfi & Reese, 2009). While children enjoy this particular pretend play, imaginary

companion that children create varies tremendously. These special friends differ in terms of both basic characteristics including their shape, age, gender, species, and complicated characteristics including vividness, longevity, activities shared together, and personality (Taylor & Mannering, 2007). Although a comprehensive definition is used for the term now, initially the definition was more stringent. Svendsen

(1934) referred to imaginary companions as invisible characters that children played for a significant period. Such a definition excludes many imaginary companions that is being recognized now including objects that are used as vehicle, also called as personified object, and the self as vehicle in which children owns the role of a pretend identity, in other words impersonation (Singer & Singer, 1990). The definition should also include aforementioned forms of pretend play as children perceive them as separate entities that they can socially interact with (Harris, 2000). Therefore, imaginary companions are now referred more broadly as a psychological concept in which individuals pretend play with invisible friends, personified objects and pretend play in the form of impersonation.

The definition of imaginary companions has an important implication on the estimate of the number of individuals who take a part in pretend play. The discrepancy is evident, while some researchers state that half of the children display an imaginary companion (Singer & Singer, 1990), some argue that only one fifth of all children have imaginary companions (Newson & Newson, 1968). In the study of Taylor and Carlson (1997), which many recent psychologists refer to and use the interview, that had been used in the study while trying to discover whether children have imaginary companions or not, a relatively stricter definition was used for imaginary companions (IC) that includes invisible friends, personified objects, and impersonation. Even this study revealed 28% of children having imaginary companion in a huge sample, in the existence of a stringent definition. Hence, generally one third of children had pretend played or

have been pretend playing with an imaginary companion.

Similar to the portion of individuals having IC to the total population, the developmental course of IC, in other words how this kind of pretend play differ in relation with age, has equivocal results. Earlier researchers argued that creating imaginary companions peak at preschool period (Manosevitz, Prentice & Wilson, 1973; Piaget, 1962), yet in a more recent study 28% of children aging between 5 and 12 had imaginary companions (Pearson et al., 2001). Another recent study also revealed that fantasy of having such a special friend continues during school period (Taylor, Carlson, Maring, Gerow & Charley, 2004) and one additional study indicates that adolescents escape mundane reality through creating imaginary worlds to pretend play their fantasy with their pretend friends and other pretend creatures inhabiting this fiction (Cohen & MacKeith, 1991). Lastly, in their study Taylor and Mannering (2007) reveal that even some adults continue having IC and pretend playing with them, yet this fantasy play decreases due to cultural expectations and explicit discouragement. Hence, individuals can create imaginary companions and pretend play with them all through the preschool to the adulthood.

Cultural differences and socioeconomic status (SES) are other factors that contribute to the variation in creation of imaginary friends and playing with them. A comprehensive study can be given as an example to illustrate this variation. The section of the study related with cultural differences demonstrated that the Mexican parents did not differ from the U.S. parents in terms of accepting personified objects, yet did differ significantly in the case of pretend play with imaginary companions

that the Mexican parents approved IC much less relative to the U.S. counterparts (Taylor, Miner, Legorreta, Luu & Perez, 2004). Moreover, the section of the study relevant to SES revealed that parents of low SES approve IC significantly less relative to parents of higher SES while reactions were similar to personified objects as it was in the form of approval (Taylor et al., 2004). Therefore, the proportion of individuals who create IC and pretend play with them to the total population, and the perspective to IC will differ considerably through the change of culture and socioeconomic status.

To understand how recent studies elaborate on imaginary companions it is important to review the trajectory of the phenomenon. The early concerns indicate that imaginary companions were perceived negatively as a signal of atypical development. This negative perception had arisen from the argument that children who displayed imaginary companions had impaired ability of distinguishing between fantasy and reality (Vostrovsky, 1895; Norsworthy & Whitley, 1918). However, many studies found empirical evidence against this argument including the study of Taylor, Cartwright and Carlson (1993) which demonstrated that children with IC understand and appreciate that their special friends are just a part of their pretend play. As children are aware that their imaginary companions are solely fictitious characters and can differentiate what is reality from what is fantasy, the argument of atypicality becomes refutable. Another negative perspective on IC and children who create them that pervaded early research is the claim of close relationship between imaginary companions and risk for psychopathology, more specifically dissociative identity disorder (DID) (Singer & Singer,

1990; Hornstein & Putnam, 1992). Various research reported that individuals with DID had more imaginary companions relative to typical individuals and the phenomenon deemed as a precursor of the disorder (Trujillo, Lewis, Yeager & Gidlow, 1996; Pica, 1999). However, like the argument of inability to distinguish reality and fantasy, this argument was refuted by various comprehensive research. Empirical results of a recent longitudinal study found no evidence for imaginary companions being the precursor of DID (Taylor, Hulette & Dishion, 2010). Furthermore, rather than being in relation with psychopathology, many studies revealed that imaginary companions are being used to cope with stressful events in individuals' lives (Friedberg, 1995). Such a finding can be exemplified with two researches of Knell (1998) and Axline (1969) which demonstrates the coping strategy of children as frequently projecting their emotions and anxieties onto toy figures (i.e. personified objects). Thus, initially creating and playing with imaginary companions perceived negatively, regarding the lack of ability to differentiate real from unreal and psychopathology, yet recently this negative view has been challenged and now the phenomenon is perceived in a positive manner as the next section will be discussing.

Early studies also include positive perspective on imaginary companions, and various positive correlates of imaginary companions were reported. After providing the results of these studies, the author will explain why one should be skeptical about both the positive and negative views on IC in earlier literature especially due to the methodological issues. Other than providing coping response to stressful events, several potential benefits of IC were reported by earlier studies including

creativity, self-control, and social skills. Piaget (1951), probably being the first to pinpoint the positive sides of imaginary companion, stated that children's symbolic or fantasy play included healthy exhibition of imaginary companions. From a more psychoanalytic perspective, children create imaginary companions as a defense mechanism as mentioned earlier, to be more specific, feelings of isolation, neglect, and rejection were at the center for compensatory mechanism of imaginary companions. Several in-depth clinical case studies reveal the activation of compensation with the creation of IC during childhood, for instance, IC may appear when the mother is pregnant or gives birth to a sibling (Benson & Pryor, 1973), when a significant other like mother, father or caregiver dies (Bach, 1971; Benson, 1980), or it may appear when parents' divorce, or when a friend is lost (Nagera, 1969). Hence, although one must be skeptical about these researches since they are case studies, it may be possible that children create and play with imaginary children to share their love and companionship without the stress of being isolated. There are other researchers in the attempt to find positive correlations of IC outside the psychoanalytic approach. For instance, Singer (1973) revealed that children with IC had various linguistic benefits and were advanced in self-control in social situations that require it. A later study again related with social skills indicated that girls with IC eliciting more positive emotions, more collaboration and sharing with their friends relative to girls without IC (Singer & Singer, 1981). Another study found similar results as children with IC displaying more positive affect and being more socially competent (Partington & Grant, 1984). Some researchers argue that these special friends

possess everything an individual can have in a healthy, collaborative relationship in the sense of maintaining secrecy, offering closeness and friendship, encouraging self-disclosure (i.e. expression of one's own self) which in turn may affect children's social skills (Buhrmester & Furman, 1987; Buhrmester, 1990). According to Singer and Singer (1990) children with IC also initiate and engage in more social play and are less likely to play alone. Moreover, five years old children that were more involved in fantasy activities were rated as having higher levels of energy, concentration, self-reliance, and frustration tolerance by their teachers (Tower, 1985). In line with previous researches, Mauro (1991) revealed that children with IC were rated by their parents as less shy, and more competent to concentrate and maintain attention relative to children without IC. In addition, one study claimed that IC during childhood is an important contributor of creativity in adolescence (Schaefer, 1969). All aforementioned research demonstrate that many positive correlates exists for children with imaginary companions in the sphere of linguistic, social, and executive skills.

The abundancy of early positive correlates studies can lead one to infer that imaginary companions are an important aspect of cognitive development. However, one research can be taken as granted to understand that one must be very critical when considering early studies in the area of imaginary companions due to the methodological reasons, and definitional reasons. The study of Seiffge-Krenke (1997) revealed that adolescents who were more socially competent and had better coping abilities were more likely to have imaginary companions. More specifically, these individuals were more ready to handle eve-

ryday problems by active support seeking and discussion with a significant other, shortly adolescents with IC displayed better readiness to tackle problems (Seiffge-Krenke, 1997). However, definitionally, this study only included individuals who constructed imaginary companions through diaries in the form of referring to someone in them. Nevertheless, it can be discussed whether an imaginary companion in the form of a diary should be accounted as an IC, also the study can be criticized that it did not include individuals that impersonate, play with personified objects, and even invisible friends. Hence, there are various earlier studies that may have definitional problems leading to possible inaccurate generalizations related with imaginary companions and their positive correlates. More importantly, methodological concerns exist for earlier studies as well. Many psychologists from the psychoanalytic approach studied this phenomenon through in-depth case studies of children, and individuals who were recruited from clinics. Hence, relatively less systematic research had been conducted on pretend play (Seiffge-Krenke, 1997), and not all the participants in these studies were psychologically healthy individuals. Taylor (1999) also argued that certain methodological issues exist within earlier studies that is the failure to compare the characteristics of individuals with imaginary companions to individuals without imaginary companions, which could provide a framework to observe different between-groups patterns. Additionally, some studies used solely retrospective methods in the form of asking adults about their imaginary companions during their childhood. Since memory can be reconstructive and inaccurate, it is not wise to consider such studies fully reliable. Therefore, not

all early imaginary companions studies should be trusted in terms of their results when the definitions and methodologies are considered skeptically. To eliminate the effect of definitional issues in recent studies, the optimum procedure that has been implemented is to interview with children with IC, and with parents of the children, and to compare both the parental reports and the reports of the children.

To have a more reliable understanding about the nature of the imaginary companions regarding the correlates, more recent studies should be examined in detail. Like early studies, there are various recent studies that revealed positive correlates of the concept. For instance, Gleason (2004) argued that since children with imaginary companions can engage in peer interactions and practice maintaining dialogues relatively more due to the ease of accessibility to IC, having an IC may potentially improve children's relationships with peers. Furthermore, there are various studies that demonstrate that children with IC are reported to have just as many or more real friends (Bouldin & Pratt, 1999; Gleason, Sebanc & Hartup, 2000; Taylor, Cartwright & Carlson, 1993). In addition, a retrospective study was done by Gleason, Jarudi and Cheek (2003) in which adults who had had imaginary companions had a stronger orientation toward others relative to those who had not had IC. According to another study of Gleason (2004), practicing dialogues with imaginary companions and sharing them with others including parents, or friends may increase the narrative skills of children with IC. Additionally, more complex syntax was displayed in the speech of children with IC, specifically using significantly more adverbial and relative clauses compared to children without IC (Bouldin, Bavin & Pratt, 2002). Another

er study, that is parallel to narrative skills and imaginary companions is the study of Trionfi and Reese (2009) in which children of five years of age who had imaginary companions demonstrated more advanced narrative skills even the fact that both children with and without IC did not differ significantly in their vocabulary skills or story comprehension. Particularly, children with IC used more dialogues when they were asked to retell narratives that they were exposed to during the study, and provided richer explanations in terms of using more temporal-locative-causal terms for the past events that they had experienced relative to children without imaginary companions (Trionfi & Reese, 2009). In their study Trionfi and Reese (2009) claimed that the underlying mechanism for such results is decontextualization competency necessary for creating imaginary companion and pretend playing with them and narrative constructing also relying heavily on decontextualization. In other words, both imaginary companion and narrative require decontextualization according to the previous researchers, and that is why children with IC are more advanced in narrative skills. Thus, various social and linguistic correlates exist regarding imaginary companions in the recent literature, yet one should not make the overgeneralization of accepting that imaginary companions create significantly substantial positive difference as there are considerably more similarities in terms of personality (Taylor & Mannering, 2007), yet when differences are accounted for, they always tend to favor children with imaginary companions as Mauro (1991) and Taylor (1999) asserted.

Several researchers have suggested that creating imaginary companions and pretend playing with them contributes to

theory of mind (ToM) development as such fantasy play harbors children's exposure to and manipulation of multiple perspectives (Astington & Jenkins, 1995; Taylor & Carlson, 1997). In this section, various studies related with the possible intersection of imaginary companion and theory of mind, and emotion understanding will be provided and discussed in a chronological order. In the study of Happé (1994) children with autism's theory of minds were tested with a battery of relatively more naturalistic and complex stories. Participants were told various stories and the experimenter asked various questions in each story that is in line with the understanding of theory of mind. Although, interestingly, children with autism spectrum disorder (ASD) could provide mental state explanations to the same extent with typically developed children, they were impaired at providing context-appropriate mental state explanations for the story characters' nonliteral utterances. This indicates that children with ASD can understand that the stories in the study require answers in the mental state domain of language to some level, yet they cannot provide appropriate mental terms (Happé, 1994). This can also be related with imaginary companions since understanding imaginary companions' thoughts is similar to understanding a fantasy character's thoughts. Shortly, the study of Happé (1994) demonstrates that children with ASD can understand required mental state words of a story to some extent yet cannot use appropriate words related with the provided context which may be related with pretense.

Early accounts usually assess theory of mind through the understanding of solely false belief and there are several early arguments on the relation between

pretense and the understanding of false belief. As being on the one side of the debate, Fodor (1992) asserted that understanding of false belief is a prerequisite for pretend playing as he believed that both concepts are functionally equivalent in terms of the similar nature of taking something unreal to be real, and taking something false to be true. On the other end of the debate, Lillard (1993, 1994) claimed that the concept of pretend play was considered to be too much sophisticated as she supported this claim by stating that no conception of mind involved at all when children engaged in pretend play whereas pretending was only a different kind of action. In addition, Perner (1991) claimed that pretense should be interpreted as a theory of behavior rather than theory of mind. Nevertheless, there are many researchers who do not consider understanding of false belief and pretense as functionally equivalent, and pretense to be lacking an understanding of mental representations, rather they stand on an intermediate position as arguing a relation between pretend play and false belief (Taylor & Carlson, 1997). For instance, in one study, having an imaginary companion was found to be positively related to understanding that a person can hold a false belief (Carlson, Gum, Davis & Molloy, 2003). In their study Taylor and Carlson (1997) asserted that examining solely attribution of false belief is insufficient to grasp the notion of ToM fully and to the ToM battery they additionally attached appearance and reality task, representational task referring to children's reports of their own former false beliefs, and interpretive diversity task which captures two people being exposed to same thing yet interpreting it differently. Although relatively stringent criteria was used to identi-

fy IC compared to early studies, a significant relation between theory of mind development and pretend play in 4-year-old children was found regardless of verbal intelligence, yet same relation could not be found for 3-year-olds (Taylor & Carlson, 1997). There may be the possibility that floor effect occurred for 3-year-olds due to the ToM assessment being difficult and not appropriate for that specific age and thus perhaps a relation could not be found. Another study in relation with IC and ToM is an extension of an earlier study about IC, which was carried out three years later than the initial study with the same participants, to see what happened to the imaginary companions of the children and more importantly to understand how imaginary companions related to the understanding of emotion. Interestingly, results indicated that the percentage of imaginary play is similar between preschool and school-age children, more importantly, school-age children with IC in the form of impersonation scored higher on emotion understanding, and theory of mind at age 4 predicted emotion understanding at age 7 indicating the connection of the two concepts (Taylor et al., 2004). Furthermore, one study was conducted to understand whether possible relations exist between interior self-knowledge and imaginary companions, and theory of mind abilities in 4 and 7 year-olds. If the two relations could be found, then a relation between imaginary companions and theory of mind could be inferred through self-knowledge. In their study, Davis, Meins, and Fernyhough (2011) provided several reasons for a possible relation between IC and self-knowledge: children with IC are knowledgeable about the fact that others cannot see their special friends (Taylor, 1999), through the use of language and behaviors,

children share the details of their imaginary companions with others (Gleason, 2004), and children aging 4 and 6 with IC performed better on referential communicative task, that was comprised of describing pictures, relative to children without IC. Therefore, it was argued that having IC could positively correlate with being familiar with the knowledge that one's thoughts and feelings are private. Additionally, it was argued that since self-knowledge tasks measure the extent to which children can comprehend the blurred natures of internal states, and other people's knowledge states, a positive association between ToM and self-knowledge should exist too (Davis, Meins & Fernyhough, 2011). The results indicated that the level of self-knowledge differed between two IC statuses in favor of children with IC meaning that those with IC had more interior self-knowledge that is in line with the argument that IC may facilitate comprehending the notion of privacy of children's worlds through self-examination and self-insight. However, contrary to predictions, neither the relation between self-knowledge and ToM nor the relation between IC status and ToM could be found. The authors concluded that self-knowledge is cognitively more complex and effortful process than theory of mind in the sense that ToM only requires understanding others' mental states whereas self-knowledge requires more steps including representing and comparing internal states (Davis, Meins & Fernyhough, 2011). Another possible reason for not finding relations can also be the fact that only a small portion of the sample had IC that is 18 children out of 80. Davis, Meins, and Fernyhough (2014) made a further study again to investigate the possible relation between IC and ToM, also to investi-

gate possible relation between IC and descriptions of a real-life friend with 5-year-old children. Children's play with imaginary companions may be related to their tendency to describe their real friends with reference to their mental characteristics. The results indicated that children with IC used more references of mental characteristics rather than physical appearance or behavioral traits in their descriptions of their best friends, in other words they were more likely to invoke thoughts, wills, expectations, and feelings while describing a real friend (Davis, Meins & Fernyhough, 2014). This tendency may derive from the greater conspicuousness of internal, mental states that is provided by creating and playing with imaginary companions (Davis, Meins & Fernyhough, 2014). Nonetheless, no association was found between the performance of ToM and children's incline to describe their friends with mental features as the authors concluded that the ability to represent everyday people in mental terms as a distinct competency that is not equal to the ability of understanding one's own thoughts and beliefs to be different than others (i.e. theory of mind) (Davis, Meins & Fernyhough, 2014). The former quality is coined as mind-mindedness and has its own body of literature (Meins, 1997). In another study children's theory of mind, emotion understanding, and IC status was again investigated yet with a more comprehensive ToM assessment compared to the one that was used in the study of Taylor and Carlson (1997). In the earlier study, to measure the ability of ToM, three types of tasks were given to children aging 3 and 5, these tasks included the ability to distinguish between appearance and reality, the ability to attribute false beliefs, and the ability to take others' perspectives. However, Giménez-

Dasí, Pons and Bender (2016) argued that this assessment was insufficient to capture other components of theory of mind such as understanding of intentionality and ignorance. Hence, after developing a more comprehensive assessment of ToM, which included additional tasks related to understanding of intentionality, ignorance, lies, jokes, double-bluffs, and second level of perspective taking and false belief, the study was conducted with 24 children aged four to six with imaginary companions and again 24 children without imaginary companions. The results were in favor of IC: children with IC regardless of their ages and genders, had a better theory of mind and emotion understanding compared to children who did not engage in pretend play (Giménez-Dasí, Pons & Bender, 2016). More specifically, IC had the biggest impact on emotion understanding compared to ToM, especially among girls. Like early researchers stated, the authors claimed that the imaginary dialogues that is established within pretend play can be the key factor for IC contributing to the development of sociocognitive abilities, also added that parents and teacher should not prevent children with playing with these special friends (Giménez-Dasí, Pons & Bender, 2016). All aforementioned studies demonstrate that there are equivocal results in the sphere of a search for a possible relation between imaginary companions and theory of mind in the sense that several researches find a connection between the two concepts whereas some studies could not find any relation.

The question that ponders is that how such discrepancies exist in the literature regarding IC and ToM since all the studies that are discussed are comprehensive and well-structured. Davis et al. (2014) argued that a competence-

performance gap in children's mentalizing abilities exists, in other words having a ToM does not necessarily lead children to spontaneously use their knowledge of internal states while representing and interpreting others and their actions. Furthermore, Apperly (2012) also discussed about the gap and how competency and performance are different from each other in the realm of theory of mind. Another possible reason for the equivocal results is that the assessment of ToM is not consistent across these studies. Each study included different composite of ToM battery, which violates the rule of standardization. Additionally, if mind-mindedness is a distinct psychological phenomenon than theory of mind, then the confusion of mind-mindedness with ToM can be another possible explanation for the equivocal results. Hence, the existence of equivocal results may derive from the unstandardized assessment of ToM, the possible gap between competence-performance of ToM, and the possible confusion of mind-mindedness with ToM.

Before proceeding to the proposal section, it is crucial to discuss the issue of causality. Every scientific research should be approached with skepticism as there can be problems with its operational definitions, internal validity, methodology and many other concepts. Although there are several researches that demonstrate positive aspects of imaginary companions, it is essential to understand that there is no empirical evidence that implies any causality for the benefits of imaginary play. To beat the causality, in other words, to surpass speculating on a causal relation between imaginary companions and ToM development, a longitudinal or a training study in which many possible covariations are controlled for can be conducted. In his study,

Dockett (1994) had trained children with creating and pretend playing with imaginary companions and reported that children in the training condition outperformed those in control group. However, since it is an unpublished dissertation, the details of the study cannot be examined in detail leading one to be skeptical about the research. Therefore, one should be cautious before inferring any causality in the field of imaginary companions and longitudinal or training studies may help clarify whether pretend play propels children's theory of mind abilities and emotion understanding, or whether children with a well-developed emotional and mental understanding tend to involve in creating and playing with imaginary companions relative to children with a less developed ToM and emotion understanding (Giménez-Dasí, Pons & Bender, 2016).

This section is devoted to make a proposal relevant to imaginary companions and theory of mind. Previous studies, in general, attempted to capture a possible relation between the two concepts by comparing children with imaginary companions to children without imaginary companions while assessing the performance of theory of mind in both groups. However, these studies provide correlations rather than causality since they are not strictly examining whether imaginary companions leading to better understanding of theory of mind, or better understanding of theory of mind leading children to be more likely to engage in pretend play. One should not forget the possibility that both pretend playing with imaginary companions and the development of theory of mind may be interacting with each other as a form of bilateral relationship. In this paper, it is proposed to make a longitudinal study that lasts four years with children with autism

at the age of four to understand if pretend play propels children's theory of mind abilities and emotion understanding or not. In such a research, causality may be inferred as children with autism at the age of four is impaired in many domains of theory of mind at the initial step of the study. If any development in ToM can be observed in the experimental group, which will be engaging in pretend playing with imaginary companions for four years, such a positive change can be encapsulated to be the reason of creating and playing with imaginary companions. Nevertheless, it is essential to use the most comprehensive, standardized and scientifically recognized measurement of theory of mind for the purpose of the internal validity of the measurement. In this proposal, it is hypothesized that children with ASD and with IC would outperform ToM tasks compared to those who do not have any IC. This directional hypothesis is done by accounting for the most recent study that had been done in the literature, which used a standardized and comprehensive battery of ToM assessment and found a relation between the two concepts, the hypothesis was also done by accounting for the fact that the number of researches that found a relation outweighs researches that could not find any. Furthermore, such a study would be interesting because its results may provide implications for the areas of education and cognitive development. Although as in line with the issue of causality carefulness is needed before advocating any encouragement to children to pretend play with imaginary companions; if the hypothesis of the proposed study cannot be refuted, creation of imaginary companions and pretend playing with them can be implemented as intervention for both children with ASD and typically developing chil-

dren. For typically developing children, this intervention can be used at day centers and early years of school so that children can develop their ToM abilities faster and earlier leading to better social skills and more empathy. For children with ASD, this intervention can diminish the impairments regarding their ToM abilities, and understanding of emotions which in turn may help these individuals function much more easily especially in social interactions. Children with autism may also engage in collaborative play by sharing their imaginary companions with each other, practicing conversations both with each other and to themselves may contribute to their sociocognitive development too. Therefore, an intervention can be done to children with autism and typically developing children to have more advanced ToM skills, if the proposed study can reach to an inference about a causal or a stronger positive relationship between imaginary companions and theory of mind.

To conclude, in this paper in the light of all previous research on theory of mind and imaginary companions, it is proposed to conduct a longitudinal study that includes an encompassing assessment of theory of mind. Before explaining the proposal, the nature of the imaginary companions is explained in terms of its definition, age, cultural differences, history, methodological issues, possible positive correlates that has been found recently. The definition now includes many kinds of play from personified objects to invisible friends, the age varies regarding these special friends that it even continues to exist during adulthood, significant cultural differences exist regarding how parents and teachers perceive imaginary companions. When the history of IC is examined carefully, it can be observed that initial negative view is

later dominated by positive view that is comprised of many studies, which indicate various positive correlates. The detailed analysis of the studies that attempt to find a relation between ToM and imaginary companions demonstrate equivocal results, yet those who found a positive relation outnumber those that could not find. From this point of view, it is proposed that children with ASD and with IC would outperform ToM tasks compared to those who do not have any IC. If a strong connection between IC and ToM can be found, then possible implications can be implemented to develop the skills related with theory of mind in children with autism that may ultimately lead to a better, closer-to-typical development especially in the sphere of cognitive and social skills.

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No Other Brain for the Second Language: Why We Should Not Rush to Settle Bilingualism on a Certain Brain Region

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In this paper, the hot topic of bilingualism is addressed, with the question of whether bilingualism has a specific brain region that enables the processing of a second language. Interdisciplinary approaches of brain imaging and neuropsychological case studies are examined with the light of the linguistic and social perspectives that illuminate the variables affecting the second language processing. Whereas it is indisputable that specific brain damages resulting in selective language preservations or losses, or to the evidence that reveal the brain specializations on first and second languages (L1 and L2), it should be noted that language is also a very social element of human cognition. Therefore, we cannot exclude the social factors that are associated with second language acquisition when we look only for the brain areas indicating the manifestation of the first or the second language. In conclusion, this paper will provide evidence for the fair grounds to doubt that there are certain brain regions for different language processing, incorporating solely the evidence of neurological underpinnings of bilingualism.

Keywords: bilingualism, bilingual aphasia, second language processing, neuropsychology

Upon the common knowledge that a considerable portion of human population is and will be bilingual, it has been the quest of the neuropsychologists to investigate the underlying brain mechanisms used to process these new languages. One of the leading studies show that the disparity of the localization of different languages only occur at the level of acquisition, in which the early phases require the engagement of additional brain regions to process the second language (L2), but this effect diminishes with the early age of acquisition and increasing proficiency of that language (Perani & Abutalebi, 2005). We can see similar effects especially in an

individual acquiring a language through making sense of it around her first language (L1), with the phonological assimilation, in which one perceives L2 phonemes on L1 phonological bases, exemplified in this paper. Ibrahim (2009) demonstrates the importance of this merger system, by showing the results of the damage in the areas involving in this type of language incorporation. In addition, damage in specific parts of the brain does not necessarily indicate the localization of one language, but rather, it discloses how stronger associations of vocabulary and grammatical knowledge are susceptible when it comes to established information

such as languages. This is also evident when the use of interaction between two languages, such as translation and other language control tasks are employed. As a comeback to those who argue that there are structural differences in brains of bilinguals, it should be reminded that the disorganized recoveries of different languages in bilinguals refute at least the benefits of such localization. Last but not least, researchers should be aware of the fact that although second language may have a tangible station at the brain, it does not develop independently of the social factors similarly affecting the brain, and this leaves the place of bilingualism ambiguous in the brain. Therefore, the position held in this paper is in favor of the argument that bilingualism is not a process of developing isolate neurological brain structures to support additional languages.

Different activation patterns are observed in a bilingual's brain, relative to that of a monolingual. These differences are not due to the mere advantage that one has because of knowing another language, because the evidence also reflects the dissimilarity within bilingual groups, depending on individual characteristics regarding the language. Li (2013) identifies a distinction of variables when studying bilingualism: the cognitive capacity and the age of onset to exposure to the second language. He also highlights the importance of the L2 proficiency in terms of the degree to which the brain is involved in dealing with two languages, regardless of the localization. Summarizing the different degrees of L2 proficiency, he discusses that the connection between the two languages can be seen in the interacting lexical knowledge of the two lan-

guages. In line with Li's arguments and based on neuroimaging studies, Perani and Abutalebi (2005) argue that compared to that of first language, the processing of L2 does not differ in the neural structures it relies on. The difference emerges when the L2 proficiency is low, then the activation extends to the adjacent structures still related to language, in addition to the shared structures involved in L1. Evidence shows that age of acquisition was negatively correlated with the grammatical processing, whereas it was not a determining factor for lexical-semantic processing, in which proficiency was more dominant (Perani & Abutalebi, 2005). The age of acquisition was especially important in the brain activations for grammar processing in both languages, with the later acquisition requiring the same and some additional neural activation in producing natural and proficient language, compared with the earlier acquisition. They also suggest that as the proficiency increases, similar mental representations start to be adopted. Lastly, the importance of the L2 proficiency of the individuals is indicated, to the degree that the neural substrates for L2 can join those for L1 (Perani & Abutalebi, 2005). In conclusion, same neural organizations are used in the acquisition of both languages, and the patterns of brain activation are steady among different linguistic tasks that one is assigned to, depending on the proficiency of the language, age of acquisition, and the proficiency in second language (Perani & Abutalebi, 2005).

Dissociation in the selective loss or preservation in one language in bilinguals is taken as a favoring argument for those who harbor the necessity for dif-

ferent specialized regions in the brain for different languages. However, several experiments show how second language is acquired by building upon the first language. Eviatar, Leikin and Ibrahim (1999) present a transcortical sensory aphasia patient who showed impairment in her native (Russian) and second (Hebrew) languages after a cerebrovascular accident. The accident resulted in right hemiparesis and aphasia, with evident lesions in basal ganglia and posterior and left corona radiate. She had intact visual abilities, which were irrelevant to her linguistic abilities. The apparent linguistic changes due to the damage were primarily the regression to the period of assimilation of Hebrew into Russian during association and antonym generation tasks (Eviatar, Leikin & Ibrahim, 1999). It was observed that the patient used a spontaneous translation from Hebrew to Russian, which was the only direction of the translation she used throughout testing (Eviatar, Leikin & Ibrahim, 1999). This assimilation was reconfirmed with a phonological perception test. Her performance for detection and discrimination of sounds were much more improved when Hebrew words were pronounced by a native Russian speaker rather than a native Hebrew speaker. This result indicated that the patient managed Hebrew words through Russian phonemes. Therefore, when this perception system was damaged, there emerged a compensatory function to enhance the perception of L2 speech through the phonological means of L1, and in this case, the Hebrew phonemes themselves were at stake because of the damage, regardless of the experience she had with the second language.

Neuroimaging studies discussed earlier (Perani & Abutalebi, 2005) suggest that during the early process of L2 acquisition, individuals might depend on their L1 knowledge. This is consistent with the aforementioned patient because she was trying to translate Hebrew words into Russian and she also assimilated Russian phonemes to make sense of Hebrew speech, as she must have done during the acquisition phase of Hebrew (Eviatar, Leikin & Ibrahim, 1999). Ibrahim (2012) demonstrates the results of the experiment he conducted upon the findings of this patient's interesting ability to assimilate Hebrew phonemes into Russian, and the positive effects of this strategy in her reading and perceptual skills in Hebrew. In accordance with that case, in his experiment the bilingual groups, consisting of Russian and Arabic native speakers with Hebrew as their second language, showed similarly enhanced perception degrees for foreign language speech with the native accent and with an accent that is more similar to their own, unlike the accent that is similar to the other bilingual group (Ibrahim, 2012). This last study reveals the importance of phonological adoption of foreign language in terms of aiding the speech perception to the bilingual speaker and shows a stronger association between the two, compared to another phonological system. This study, thus, supports the situation observed in the Russian bilingual aphasic described in Eviatar et al.'s (1999) article. Based on these studies, we can conclude that the second language relies on the mechanisms involving the first language for its development, suggesting that there

are not necessarily separate channels for different language.

In some neuropsychological cases, it can be observed that a bilingual's proficiency exacerbates in one language but not in the other, but these examples should not be exaggerated to the level that the damaged parts of the brain are necessarily responsible for the processing of one language only. Ibrahim (2012) introduces a right-handed Arabic native speaker, who is proficient in Hebrew for over decades, suffering from a brain damage affecting his left temporal lobe and right frontal subdural hematoma. Following the lesions, he shows dissociation preserving Arabic but severely impairing Hebrew language skills. In Hebrew, he exhibits paraphasic errors with name finding difficulties, whereas in Arabic, he shows a small extent of hearing disturbances but other than that, his speech is almost fluent. Even after treatment, he makes a great improvement in both languages, but more significantly in his first language - Arabic. His anomia is managed in Arabic but further deteriorated in Hebrew. His reading was also poorer in Hebrew although he used similar tactics he used reading Arabic. An interesting finding is the way he assimilates Hebrew sounds into Arabic, he also does that when spelling words, he uses Arabic phonemes to spell Hebrew words, which was the strategy used by the aphasic native Russian speaker, described by Eviantar et al (1999). Thus, this study shows the dissociation between two languages upon specific damage. Yet, one should be more prudent before concluding that there are different localizations for different languages. Rather, this case agrees with the perspective that empha-

sizes the strength of association of the first language compared to the following ones, as was the case defended for the selective impairment caused by left basal ganglia damage in Adrover-Roig et al.'s illustration (2011). Ibrahim (2009) also speculates that the anomia symptoms could be caused by impairment in lexical retrieval mechanism. These assumptions could be interpreted as the damage was in a particular location that assimilates Hebrew into Arabic, as done in the phonetic perception in the early language acquirers, as well as the neuroimaging study formerly discussed, which discussed the additional networks for second language in the brain.

First language is associated with stronger links of lexical and syntactic information, relative to subsequent languages, which is why one of the postulated centers of implicit memory, basal ganglia, has been recognized as the most responsible neural substrate for L1. This was maintained in the case submitted by Adrover-Roig et al. (2011), in which the patient, who had left basal ganglia damage showed accelerated speech in L1, Basque, as opposed to L2, Spanish, which caused the former to be unintelligible at some point. But the patient was able to slow down upon instruction. Unlike what is more common, the patient became more accurate when translating L1 to L2, showing that he had lost availability to Basque lexical system. In addition, in tasks that required more automatic processing such as counting months and numbers, the patient was more impaired completing the task in L1, and involuntarily switched to L2. This case in hand encouraged the assumption by

Tschirren and colleagues (2011) who followed the assumption that neural structures for implicit memory, namely fronto-subcortical loops involving basal ganglia and left frontal lobes, entangles more with the acquisition and utilization of the first language, given its automatic nature in individual's life. On the other hand, given that the second language relies more on the explicit memory, involving bilateral temporal lobe structures, because it requires more effort than L1, the researchers expected that anterior lesions in the brain, rather than posterior lesions, would cause significantly less impairment in L2 syntactic processing. However, they obtained the opposite results in which the anterior lesion was associated with improved performance in L1 rather than L2. In addition, only the patients with anterior lesion had preserved L1 processing, as opposed to that expected from L2. Thus, the processing of different languages is not undertaken by completely different brain structures as expected in their hypothesis, and is consistent with Abutalebi and Perani's neuroimaging studies (2005). They are also more in line with the involvement of basal ganglia as procedural memory's role in first language usage, with its stronger associations established in the brain, and that thus, L2 is more susceptible to simply any lesion in language areas, at least in syntactic processing.

Language control can be analyzed in terms of the interaction between L1 and L2, with the outcome relating these executive capacities to the interaction between different brain regions devoted to different languages. Hervais-Adelman, Moser-Mercer, and Golestani (2011) observed the neural substrates of

language control, language switching particularly, from different perspectives, such as neuroimaging and neuropsychology. Setting off from Adrover-Roig et al.'s (2011) case, in which the patient's basal ganglia was associated with severely impaired use of L1, arose the argument that the basal ganglia is involved with the control of the strongest linguistic association. A language mixing case was studied in which the patient received damage in the left caudate nucleus and language switching problems were observed after damage to anterior cingulate gyrus, as well as white matter adjacent to frontal gyrus (Adrover-Roig et al., 2011). Both language switching, meaning changing the language of discourse along sentences, and language mixing, where one borrows foreign words into sentences, were observed in a patient with bilingual subcortical aphasia, with the condition affecting both languages, and translation abilities. The damage was lateralized in the left hemisphere, with decreased blood delivery to fronto-parietal and temporal regions, and caudate nucleus. Activation processes, given the negativity of the activation after few hundred milliseconds upon language switching tasks, N250-400 to be clear, could also explain language selection depending on the translation direction, explaining the inhibition process of the non-target language. Although these inquiries might be important in explaining language control skills in bilinguals, they still do not account for the individual and exclusive activation of one of the languages that the individuals speak.

Although there is neurological evidence of structural differences between bilinguals and monolinguals,

there is no sufficient evidence against the connectivity of brain when it comes to bilinguals. Mechelli et al. (2004) demonstrated the investigation of grey matter density in the brain, comparing bilinguals and monolinguals; the results showed that there was a significantly greater density of grey matter in the left inferior parietal cortex of the bilingual individuals, compared to the monolinguals. The further examinations determined that, first of all, age of acquisition was negatively correlated with the grey-matter density in the left inferior parietal cortex, while proficiency was positively correlated with grey-matter density with the exact same region. While this study would pave the way for the specialized regions in brain for different languages, Fabbro's study (2001) provides contradictory evidence showing that the comparison of different language impairments among patients with aphasia due to left hemisphere lesion indicated that more than half of the patients showed similar degrees of impairment in both languages, whereas those that show greater impairment in L1 or L2 are rather small and with close propensity to each other. This contradicts with the hypotheses that the first language would always have a privilege in recovery. If the brain structures were to be the exceptional underlying mechanism for the processing of single languages, we would not see such a peculiar order in recovery.

The assumption that the brain devotes distinct regions for different languages should be questioned because besides the languages spoken by the individual, their interaction with the social environment plays a con-

siderable role in conceiving the changes in the brain. Rivera Mindt et al. (2008) discussed the different perspectives to adopt while evaluating bilinguals, considering it an important pursuit given the already significant and increasing bilingual population in the USA. As they advocate the advantage of bilingualism when it comes to inhibitory control, it is also known that those executive functions could be compromised upon brain damage, according to Hervais-Adelman et al. (2011). What is striking in this paper is that the positive effects of bilingualism cannot be accounted for without the variable of socioeconomic status. The studies summarized in this review article conclude that benefiting executive functions by bilingualism is positively correlated with the socioeconomic status, and if there is no such relationship, the effect will be insignificant. Another experiment was undertaken by Ibrahim (2012), about the relationship between the empathic capacity towards a culture represented by language and the degree of accent. Here, the foreign language was determined as Hebrew, and the bilingual participants were Russians and Arabs living in Israel. In the first study, none of the bilingual groups showed difference in relationship between each other on the degree of accent and the empathic capacity. However, it was observed that the relationship between these two variables was a significant negative correlation in the case of Russians, whereas it was only a moderate correlation for Arabs. These are important analyses because they could play a major part in disagreeing stud-

ies that defend the localization for each language in bilingual individuals. Authors with such positions should not jump to the conclusion that when one is bilingual and there is a significant structural difference in the brain, it is necessarily a consequence of being bilingual. They should also consider the power of variables such as, education and quality of education, socioeconomic status, acculturation and assimilation, and social support (Rivera-Mindt et al., 2008).

In conclusion, researchers have tried to tackle the issue of bilingualism adopting many various perspectives, from neuropsychology to neuroimaging, considering the linguistic and social factors that are influential in the analysis of the process. It has been detected that during the early phases of language acquisition, there are several distinctions in brain activation and functioning (Perani & Abutalebi, 2005), and damage to certain brain structures can cause a major effect in the use of one of the two languages in bilinguals, if not both (Ibrahim, 2009). The damage may also lead to the recession of language learning level in which strong associations are weakened, forcing the process to reset, as we saw in the case of Russian bilingual (Eviatar, Leikin, & Ibrahim, 1999). In addition to the biological factors that sustain the bilingual process, it is important to note the social factors through which the individual behaves as an active user of the language. Among these social factors are the socioeconomic status and the quality of education of second lan-

guage and otherwise, empathy towards the culture, as well as the individual engagement in the language, with the socialization processes, as well as the level of that language and the language structure itself. Looking at these interactions of social and biological factors, it is difficult to conclude that bilingualism has a particular region in the brain that possesses this interesting phenomenon, because bilingualism is a concept that cannot be considered only with the neurological disposition of the individual, but it has to address the environmental factors, as well.

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