

**IMPRESSION AND EYE MOVEMENTS: AN EYE-TRACKING
INVESTIGATION AMONG YOUTH IN SIKKIM**

A Dissertation Submitted

To

Sikkim University



In Partial Fulfilment of the Requirement for the

Degree of Master of Philosophy

By

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DECLARATON

The work embodied in the dissertation entitled ‘Impression and eye movements: An Eye-Tracking investigation among youth in Sikkim’ was conducted at the department of Psychology under School of Human Science, Sikkim University, in partial fulfilment of the requirement for the award of Master of Philosophy of Sikkim University. The work has not been submitted for any other degree to this university or any other university or institution.

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CERTIFICATE

This is to certify that the dissertation entitled 'Impression and eye movements: An Eye-Tracking investigation among youth in Sikkim' submitted by Mr. Viplav Tuladhar (Roll No. 18MPPS04 and Reg No. 18/M.Phil/PSY/04) in partial fulfillment of the requirement for the award of Master of Arts of Sikkim University has not been previously submitted for award of any degree/ diploma of this or any other University and it is his original work. He has been working under my supervision.

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ABSTRACT

Previous research shows that when individuals are forming impressions about a person, they focus on the eyes and gaze behaviour of the person. But most of these studies are based on purely facial regions or the face with no other aspect of the stimulus person is visible. The present research examines how eyes movements are linked to impression formation when the whole person is visible to the participants. It explores where people look while they form impressions, and how does image characteristics (action & gender) and prior information of actor influences eye movements. Two studies were conducted on university students using eye-tracking device to test the hypotheses. The first study was a 4x2 (4 groups x 2 repeated instruction) mixed experimental design (N=40, mean age= 22.15). The experiment contained a single image in greyscale, within which 4 actors were present. The participants were divided among 4 instructional groups (free look, impression, free look then impression, impression then free look). The results show that the participants viewed faces of the actors significantly more in the impression instructional condition compared to the free look condition. It was also found that the participants viewed the actors in action poses significantly more than those in non-action condition. However, no effect of gender of the actors on the participants impressions about the actors has been found.

The second experiment was a within-subject design (N=40, mean age= 21.82). The participants were shown 36 image slides having two actors in each, with different characteristics i.e. some were shown with information, some had different familiarity of actors in them. Results indicate that participants showed a significant interest in unfamiliar faces compared to familiar faces. Similar to the first study, results of the

present study also show that participants view actors in action poses significantly more than actors in non-action poses. When information regarding actors were given before the images of the actors, participants viewed images of actors with information more than images with actors without information. Polarity of the information had no bearing on the participants eye gaze in their following image slides. The overall results show that faces are viewed significantly more during impression formation than rest of the body. Action poses are seen more than non-action poses. Self-referential stimuli had no effect on participant eye movements, rather participants non-referential significantly more. Finally, when information is provided about the actors before their images, participants spend more time on actors. The results imply that even when shown the whole person as a visual stimulus, individuals would prioritize and view the facial region more during the act of forming impressions. When participants are shown an image with action pose and non-action pose, the action in the image garners more attention. Hence the action in an image is prioritized over non-action images.

CHAPTER 1: INTRODUCTION

We view the world through the medium of our eyes and through the cognitive and social processes behind them, we understand the phenomenon, environment and people around us. Trying to understand how our eyes move or how they shift during various situations have been major topics in various past researches in the academic space. The history of research on where a person looks has shown that eyes are inextricably linked to control of behaviour, is subject to tasks given to them, their awareness, and much more (Borji & Itti, 2013; Yarbus, 1967). There is no dearth of researches in the field of impression formation as it is one of the parts of human psyche that is actively being used daily. We form impressions of one another, using their environment, behaviours, facial features, etc. (Anderson, 1965; Hagiwara, 1975; Heide, D'Angelo & Schumaker, 2012). And to understand these impressions researchers have used methods leading from self-report to fMRI, but the use of eye tracking is not well received. Using the visual cues on and around a person to form impressions is vital (Cook & Smith, 1975; Fukayama, Ohno, Mukawa, Sawaki, & Hagita, 2002; Kendon & Cook, 1969), and hence eye movements are incorporated into the mix, but it is largely untapped.

Studies mentioning and quoting eye movements and position of eyes in impression formation are many, but they mostly do not use an eye tracking measure but rather a self-report one. Though there may some truth in these self-reported statements about eye movements, but it has been shown that we are not as aware of our eye movements as we think. Mostly studies linking impression formation and eye movement talk about the time of gaze of the participant and the target, but do not extricate how the process of impression formation itself changes the movement of the

eyes of the participant and where they look at the target and other portions of the environment when they are performing said task.

The present research focused on how the act of impression formation is linked and effects eye movements. This research concentrates on the eye movements of the participants when they are performing the act of impression formation through the images of people. Specifically, the study examines where do people look during impression formation; does people look differently to images when they are involved in impression formation than when they are in free look mode. The study also examines the characteristics of the image that could affect eye movements which in turn would affect impressions of the participants i.e. how does the gender or action of the actors in the image change a participant's eye movements.

CHAPTER 2: LITERATURE REVIEW

Impression Formation

Impressions are cognitive structures that we form to quickly categorize and classify individuals that we meet, which are usually created with minimal information and are often accurate. The seminal work in impression formation research was by Solomon Asch, his research on how information was integrated by individuals about personality traits (Asch, 1946). There are two major impression formation approaches – gestalt approach and the cognitive algebra approach. The first approach, based upon the gestalt theorem of psychology, believes that the individuals would gather all information possible and then create an impression based upon the coalescence of all these disparate pieces of information. Whereas the cognitive algebra approach follows the basis that information is separate individual pieces which can be used in an additive manner rather than being a part of the whole like in gestalt approach (Roetkelein, 2006).

Impression formation researchers often use person perception theories to create and support theories of impression formation. There has been research using these theories to create a theory for impression formation, Anderson used integration theory and attitude change to create a theory supporting cognitive algebra approach of impression formation (Anderson, 1971; Anderson, 1974). Himmelfarb in their research showed that attribution and integration theories were used in conjunction by individuals when they form impressions about personality (Himmelfarb, 1972).

Research has shown that when impressions are being formed, they can supplement themselves with the use of verbal and/or non-verbal information in and around the environment (Adaval, Isbell & Wyer, 2006; Anderson, 1965; Anderson &

Lampel, 1968; Hagiwara, 1975). Specifically information about the gender and race are shown to play very important role in the formation of impression of others and often using this information results in stereotype-based impressions (Kunda & Thagard, 1996; Locksley, Bordiga, Nancy & Hepburn, 1980; Paunonen et al., 1999; Senft, Chetsova-Dutton & Patten, 2016). Other information that is visually notable, are the behaviours such as expressiveness and outwards confidence and fluidity are shown to lead to a more positive impression (Riggio & Friedman, 1986). During impression formation any behaviour or information presented to the person that is inconsistent with the targets perceived personality, is given more attention to and is more readily recalled than information or behaviour that is consistent with the perceived personality (Belmore, 1987). Another type of information that can influence impressions is, self-referential or self-similarity with targets during impression formation, which increase memorability and positivity of the person and impression (Leshikar, Cassidy & Gutchess, 2015; Kristof-Brown, Barrick & Franke, 2002).

In the process of impression formation, there are times when one is provided information about the target. When provided such information, these are used readily and can often drastically change one's impression of target. It has been found that negative personality traits, behaviours and information generally outweigh positive ones and effect the impressions respectively (Anderson, 1965; Fiske, 1980; Kaplan, 1971). Ikegami has also shown that there is a significant asymmetry in the assimilation of information when forming impressions, mainly the negative information is assimilated more readily than positive information (Ikegami, 1993). When comparing positive and negative information when forming impressions of actors that are not immediately accessible to us, we are more likely to give preference to negative information and behaviour while disregarding positive information (Ruva,

Guenther, & Yarbrough, 2011; Vonk, 1996). Researchers also found a negativity bias in impression formation, that is, when provided negative and positive information in a sequence, negative information is given higher overall importance as compared to positive information (Pligt & Eiser, 1980; Richey, McClelland, & Shimkunas, 1967; Skowronski & Carlston, 1989).

Eye Tracking

Eye tracking is a measure where a respondent's eye movements are recorded in conjunction with the stimulus that they are viewing; the measures main draw is the ability to know where the respondents viewing in the stimuli they are shown. In 1879, Louis Emile Javal expanded upon eye movements and observed that the act of reading is not actually a smooth sweeping motion but rather, consists of shortstops (fixations) and quick saccades. The first non-intrusive eye tracker was built in 1922 by Guy Thomas Buswell. Alfred L. Yarbus, in the 1950s and 60s, did several important advancements in eye tracking, most notable being his book *Eye movements and vision*, published in 1967 (Yarbus, 1967). The 1970s saw the rapid expansion of eye tracking and eye tracking facilities particularly research on reading. An overview of this period is given by Keith Rayner (1998). During the 1980s eye tracking expanded into the study the question of human-computer interactions. Additionally, the use and prevalence of computers allowed researchers to view eye-tracking results in real time. The present eye tracking research often focus on the interaction of humans with different computer interfaces and web development (Jacob & Karn, 2003).

Eye movements are a well-established measure for cognitive structures, e.g. impression formation, stereotype personality assessment, social attention, etc., that can be explained by the movement of one's eyes. Two kinds of eye movements are generally observed, voluntary and involuntary. Voluntary eye movements are

conscious eye movements that are made with concentrated effort and are movements that one can remember. Whereas involuntary eye movements are those movements that are not explicitly controlled by one, these movements are often connected to our eye muscles suddenly contracting or relaxing. Even though that we are not able to know the movements of involuntary eye movements, there is proof that the information that is scanned during this period is also retained by the participants (Duchowski, 2007). Though they are involuntary, they are not entirely random, rather they are connected to the same part of the brain that controls the voluntary behaviour of these eye movements (Salk Institute, 2009).

Eye tracking is a well-used measure in market research, mainly visual marketing and online marketing since the rise of online shopping portals such as Amazon, ebay, Alibaba, Flipkart etc. Major research in this area is based upon consumers selection process, how their fixations and eye movement were related to their selected choice. Under time constraint it has been seen that participants would filter textual information and change their processing strategy for information acquisition (Pieters & Warlop, 1999; Russo & Leclerc, 1994). Research on consumer eye gaze behaviour in online market decision making, identifies that consumers would switch between multiple acquisition strategies and change their gaze behaviour according to the information they acquire (Shi, Wedel & Pieters, 2013).

Evolutionary biology suggests that our eyes are attracted to action compared to inaction in nature (Johnson, 2006; Johansson , 1973; Snowden & Freeman, 2004). When it comes to still images of action and inaction there is not much of a differentiation factor, although the above would suggest that action images would garner a modicum of interest more when compared to images with inaction. Action or inaction in this situation suggests to the capturing of images with persons in action i.e.

moving, eating, jumping, laughing, conversing, etc. These images are to be a cause of attention as active images are known to be more attractive to the eyes than inactive (Birmingham, Bischof, & Kingstone, 2008). Another line of research shows that, we are more attracted to the stimulus and information that is self-referential i.e. information that corresponds to us, and this is shown to influence eye movements and even change brain patterns. It has been seen that self-referential stimulus is attended to significantly more than stimuli that are not self-referential (Shelley-Tremblay & Mack, 1999; Wisco, 2009). Research has shown that participants internal traits might have a significant effect on their eye movement and their interpretations of stimulus they view (Wilkowski, Robinson, Gordon & Troop-Gordon, 2007). It has been shown that individuals who have high social anxiety often avoid direct gaze behaviour and move their eyes away from the stimulus faces to avoid the direct eye gaze behaviour (Weiser, Pauli, Alpers & Mühlberger, 2009).

Eye Movements and Impression Formation

Much research regarding impression formation through non-verbal information is conducted using visual stimulus, the use of this visual stimulus is a verified and well-recognized stand-in for studies that require non-verbal information. When using visual information, we often form impressions based on the various visual cues that can be easily understood by the larger population. The use of facial expressions is one of the most common in all, even Yarbus's original work included the understanding of facial expressions (Yarbus, 1967). Judgements and impressions based on non-verbal cues and information are shown to be accurate in the domain of dispositional traits, and that they also influence subsequent judgements of a target's action (Naylor, 2007).

Multiple researches shown that when forming impressions participants give significantly more attention to the eyes and their gaze (Fukayama et al., 2002; Jaink, Wellens, Goldberg, & Dell'osso, 1978; Kendon & Cook, 1969). The amount of gaze is also shown to be directly linked to the positiveness or favourableness when impressions are formed (Cook & Smith, 1975). The numerous researches have shown that attractiveness of the subject in a visual stimulus is a major player in impression formation (Hagiwara, 1975; Heide et al., 2012; Miller & Seidman, 2013). It has been recorded that generally targets that have larger eyes are perceived to be warmer, competent and generally resulting in positive impressions (Gonçalves, Gomes, Ferrãro, Parreira, dos Santos, Giger, & Martins, 2015). When forming initial impressions (first impressions) they are generally based on the targets facial appearance and disposition and are consistent across participants (Bar, Neta, & Linz, 2006). Smiling is perceived more and given more positive bias when judging targets, and it also reduces the use of information based on race or gender during impressions formation (Sneft, Chentsova-Dutton, & Patten, 2016). A person's body language specifically the physical posture and their gaze behaviour towards the observer, and colour of clothing are also of particular interest to those forming impression (Borji & Itti, 2014; Greenlees, Buscombe, Thelwell, Holder, & Rimmer, 2005; Greenlees, Leyland, Thelwell, & Filby, 2008; Harper, Wiens, & Matarazzo, 1978; Janik et al., 1978).

The Present Research

The present research tries to understand the effects of impression formation on the eye movements. Following on prior researches, it is seen that there is a research gap in this specific section. Limited research explored the effect of impression formation on eye movements. This research focuses on the changes that occur in the

eye movement, its pattern and where do people look while performing the task of impression formation. The study also examines how the target characteristics, such as similarity, action, and familiarity, influence the eye movement during impression formation. The following research question and hypotheses are formed:

Research Questions and Hypotheses.

RQ1. Where do we look when we form impressions of others?

H1. Participants will view the eyes and head significantly (i.e. face) more than the body when forming impressions.

RQ2. How does action pose in the images effect impression formation?

H2. Participants will view stimulus with action poses more than without action poses.

RQ3. Does self-referential stimulus effect our eyes during impression formation?

H3a. Participants will view self-referential stimulus more than non-referential stimulus.

H3b. Self-referential stimuli will be given a more positive judgement than non-referential stimulus.

RQ4. Does information provided prior to impression formation effect eye movements?

H4a. Person with negative characteristics will be viewed significantly more than positive characteristics.

H4b. Prior information will be evaluated significantly more than no information.

CHAPTER 3: STUDY 1

The first study is conducted using an image to measure participants' impressions about actors in the image using an eye tracker. The participants were shown an image and an instruction was given to them while they are observing the image (Borji & Itti, 2014; Yarbus, 1967). This study helps us understand how the participants would react to the actors when under the condition of forming impressions and how their eye movements would change between different types of instructional conditions. The image also is for comparison between how the participants' eye movements change due to actor's gender and how it affects their impressions.

Method

Participants. The sample size for this experiment was 40. The participants were between the ages of 18 to 25 with a mean age of 22.150 and $SD = 1.762$. All participants were from Sikkim University. There were 17 male participants and 23 female participants. The participants were randomly assigned between the 4 experimental groups, with 10 participants in each group.

Tools.

Visual Task. The task used an image containing 4 actors (2 males, 2 females). The image was sized to 1920x 1080 pixels to fill the entire screen and the image was in grey scale. The image was selected from multiple images by two external observers based on two criteria- cultural relevance and how natural it looks. The task was to either view the image in a free look condition or to judge the actors in the image in the impression condition (provided in the appendix).

Eye-tracking Machine. Tobii eye tracker, the TX300 was used in this experiment created by Tobii Technology. It has a maximum recording speed of 300 Hz. Tobii studio was used to create, conduct and access the data of the experiment.

Impression Scale. The impression was measured by using a paired comparison scale where on one side the adjectives were positive, and the other side were negatively polar adjectives, e.g. friendly-hostile, reliable-unreliable.

Design. The experiment had two sets of instructional conditions - impression condition and free look condition, the two instructional conditions were used to create 4 instructional groups (see Table 1). Two instructional groups are used to compare the difference between the eye movements during impression formation and free look, group 3 and 4 gives a within comparison of the two instructional conditions. Ten participants were sorted into each instructional group. After the image, the participants will be given a scale with an outline of the actors (provided in the appendix) in the image to check their impressions about the actors in the image.

Table 1

Presenting the participant groups used in the study

| | | | | |
|---------|------------|-------------|------------|-------------|
| Group 1 | Impression | Measurement | | |
| Group 2 | Free Look | Measurement | | |
| Group 3 | Impression | Filler task | Free Look | Measurement |
| Group 4 | Free Look | Filler task | Impression | Measurement |

Procedure. The participants were invited in the psychology laboratory to take part in the experiment. The participants were explained that they were going to be a part of an eye tracking experiment. They were briefly informed about the purpose and

procedure of the experiment and then their informed consent was taken. The participants were asked to sit comfortably in front of the eye tracking device, their eyes were calibrated to the machine, then the experiment was conducted. All participants before being shown the image were given instructions according to their group and shown the image for 60 seconds.

In the first group, the participants were instructed to “look carefully at the image and judge the people in the image using your insight” adapted from a prior research (Greenlees et al., 2005). They were shown the image for 60 seconds, after which their impressions about the actors were measured using the impression scale (mentioned in the method section) together with an outline sketch of the actors so that the participants had a reference of their positions and whom they were rating in the scale. In the second group, free look, the participants were instructed to “look at the screen” and were shown the image for 60 seconds, after which their impressions about the actors were measured using the impression scale and outline sketch.

For the third group, impression look followed by free look, the participants were first given the impression look instruction, same as given to Group 1, and shown the image for 60 seconds. After that, they were provided a filler task, i.e. digit cancellation task for one minute, and then they were given the free look instruction and the same image was shown to them for 60 seconds. Then the participants were given the impression scale with the sketch. In group 4, free look followed by impression look, the participants were given the free look instruction, then provided a digit cancellation task for one minute. After that the impression formation instructions were given, and image was shown to them again for 60 seconds. Then the participants were given the impression scale with the sketch. The participants were thanked for

their participation; they were debriefed about what the purpose of the experiment.

And they were given a compensation of Rs. 100 for their participation.

Results

Table 2 presents the differences in total fixation duration caused by the actor's physical characteristics, i.e. face and body of the actors, and instruction conditions, i.e. free look or impression look. It shows that participants viewed the face of the actors significantly more than the body of the actors; $F = 165.211$, $p < .001$. The table further shows that participants who were in the impression look condition viewed the actors in image significantly more than participants who were in free look condition; $F = 22.322$, $p < .001$. Results show that there is a significant interactional effect of instruction conditions and physical characteristics of actors; $F_{(1,58)} = 6.974$, $p = .011$. The participants viewed the faces of the actors significantly more in the impression condition when compared to free look condition.

Table 2

Total fixation duration for various characteristics and instruction conditions

| Pair | Image | Mean | SD | F | Sig. | η_p^2 |
|--------------------------|------------|-------|-------|---------|-------|------------|
| Physical Characteristics | Face | 9.344 | 4.171 | 165.211 | <.001 | 0.740 |
| | Body | 2.752 | 1.601 | | | |
| Instruction | Impression | 7.289 | 2.150 | 22.322 | <.001 | 0.278 |
| | Free Look | 4.807 | 1.913 | | | |
| Face | Impression | 11.26 | 3.773 | 6.974 | .011 | 0.107 |
| | Free Look | 7.426 | 3.679 | | | |
| Body | Impression | 3.316 | 1.767 | | | |
| | Free Look | 2.188 | 1.197 | | | |

#N=60; N=30 for each instructional group

Figure 1. Total Fixation Duration of Physical Characteristics and Instructional

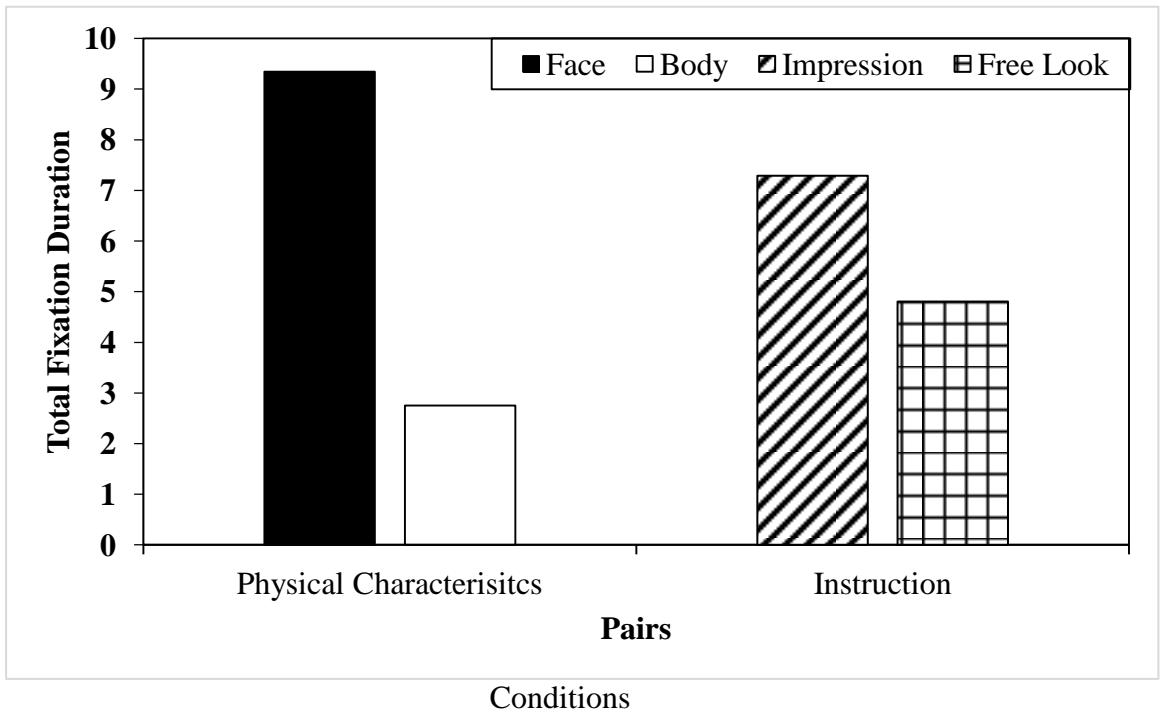
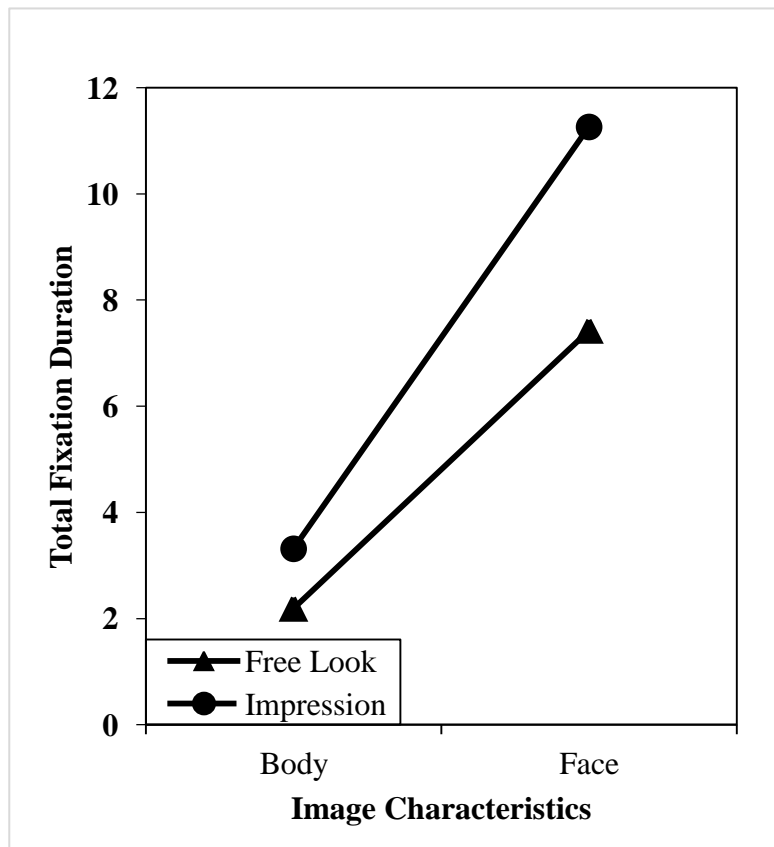


Figure 2. Total Fixation Duration against Physical Characteristics and Instructional



Conditions

Figure 1 presents the main effects of both physical characteristics of the actors and the instructional conditions. In both pairs we see a marked difference, face is significantly higher than body and impression is significantly higher than free look.

Figure 2 presents the interaction effect between bodily characteristics and instructional condition. It shows face is seen more than body in both conditions, but the difference is vaster in impression condition compared to free look condition.

Table 3

Difference in fixation duration due to action and non-action actor poses

| Image | Mean | SD | t | Sig. | d |
|------------|-------|-------|-------|-------|-------|
| Action | 6.646 | 2.463 | 4.509 | <.001 | 0.582 |
| Non-Action | 5.450 | 2.704 | | | |

#N=60

Table 3 shows the difference in fixation duration between the action and non-action poses of the actors shown in the image. The participants view action poses significantly actors more than non-action poses actors; $t_{(60)} = 4.509$, $p < .001$.

Table 4

Participant gender difference between fixation duration on actor genders

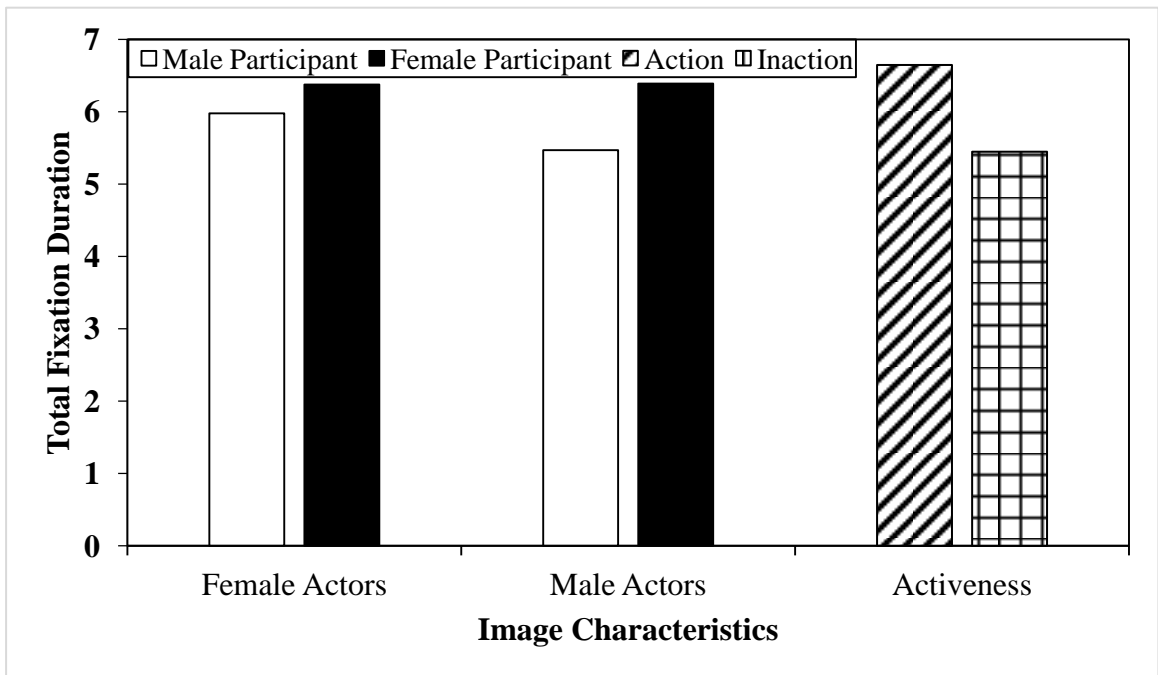
| Image | Participant Gender | Mean | SD | t | Sig. | d |
|---------------|--------------------|-------|-------|-------|------|-------|
| Female Actors | Male | 5.980 | 2.671 | 0.450 | .655 | 0.145 |
| | Female | 6.377 | 2.820 | | | |
| Male Actors | Male | 5.472 | 2.179 | 1.148 | .258 | 0.373 |

| | | | | | | |
|--|--------|-------|-------|--|--|--|
| | Female | 6.389 | 2.706 | | | |
|--|--------|-------|-------|--|--|--|

#Male N=17, Female N=23

Table 4 presents the differences between actor genders due to participant genders on fixation duration. Results show that there is no significant difference between males and females in total fixation duration for female actors; $t_{(39)} = 0.450$, $p = .655$. And there is no significant difference between males and females in total fixation duration for male actors is found; $t_{(39)} = 1.148$, $p = .258$.

Figure 3. Total Fixation Duration of Multiple Image Characteristics



The third figure presents the total fixation duration of the specific image characteristics. The first and second sets of bars show how participant gender effects their viewing of female actors. There is no significant statistical difference due to participant genders in fixation time for both the actors. The final set of bars represents the difference between fixation time of actors in action and actors with no action.

Although the second graph has a similar gap seen in the figure the participants viewed actors with action significantly more than actors with no action.

Table 5

Participant gender difference between actor impressions

| Impressions | Participant Gender | Mean | SD | t | Sig. | d |
|---------------|--------------------|--------|-------|-------|------|-------|
| Male Actors | Male | 13.882 | 8.529 | 0.049 | .960 | 0.016 |
| | Female | 13.739 | 9.289 | | | |
| Female Actors | Male | 14.471 | 7.600 | 0.466 | .643 | 0.150 |
| | Female | 13.304 | 7.968 | | | |

#Male N=17, Female N=23

The difference caused by participant gender in actor impressions is presented in Table 5. We can see no difference in positive or negative impressions about the actor due to the gender of the participants. Gender of the actors nor the gender of the participants had any effect on the impressions about the actors. Figure 4 shows the difference between male and female participants impressions about the actors in the image. We see no significant graphical difference in Figure 4 for both the male actor and female actor impressions due to the participant gender.

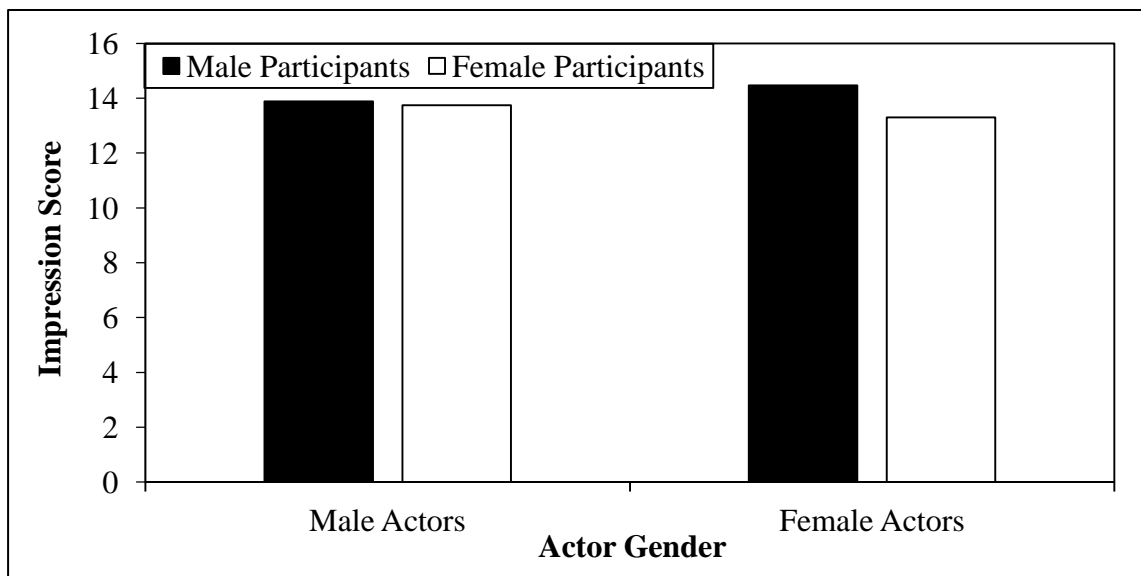


Figure 4. Participant Impressions about Actors in the Image

CHAPTER 4: STUDY 2

The second study is conducted to test the hypotheses that could not be tested in the first study i.e. participants will view self-referential stimulus more than non-referential stimulus, person with negative characteristics will be viewed significantly more than positive characteristics, and prior information will be evaluated significantly more than no information. Additionally the present study also aims to overcome the limitations of the first study, such as – the image used in previous study does not show the complete portrait of actors, the actors were sitting behind a table which caused their head to be similarly sized to their body. Similarly, to make the image look natural, we kept the background information in the image. The background in the image may have distracted and caused some change in eye movement. In the present study we have tried resolve these issues as well.

Methods

Participants. Total 40 university students participated in this study. Two participants were dropped from final analysis due being outliers (based upon box analysis). Hence 38 participants were present in the experiment, 15 males and 23 females. Mean age of the participants was 21.82, SD = 2.789.

Tools.

Visual Task. There were two types of visual slides, 36 image slides and 24 information slides. Both slides were 1920x1080 pixels and in greyscale, with a 200-pixel black line in the middle. All image slides had one actor on each side, the actors were shown on the white background. Twelve image slides were accompanied with information slides, which had information about the actors on one side and no information or blank on the either side. That is, every image slide has two actors, however, here the information was provided for only one actor. Another 12 image slides were accompanied with information slides with positive or negative information of both actors present in the image. That is, one side had positive information and other side had negative information about the actors. The final 12 image slides were not given with prior information, however here the actors differ in terms of familiarity on or unfamiliar to the participants. To make the actor familiar, the image of Bollywood actor and actress have been taken. The distribution of image and information slides is presented in Table 6. All image slides were shown for 5 seconds, information/blank slides were shown for 2 seconds and positive/negative information slides were shown for 4 seconds.

Table 6

Image sets with their respective information and actor characteristics

| Number of Images | Information Slides | Actor Characteristics |
|------------------|--------------------|-----------------------|
|------------------|--------------------|-----------------------|

| | | |
|----|---|-------------------------|
| 12 | Information (positive, negative, neutral) and Blank | Unfamiliar Both Sides |
| 12 | Positive and Negative information | Unfamiliar Both Sides |
| 12 | No prior information | Unfamiliar and Familiar |

Eye-tracking Machine. Tobii eye tracker, the TX300 was used in this experiment created by Tobii Technology. It has a maximum recording speed of 300 Hz. Tobii studio was used to create, conduct and access the data of the experiment.

Design. The experiment was a repeated measure design where all participants viewed all the images in the experiment. The study had two major variables – information that would be shown to the participants before the images of the actors, and characteristics of actor in the images- familiarity or unfamiliarity. Twenty-four image slides were accompanied with different types of information slides and remaining 12 image slides had no information at all, but rather had different actors in them. The design could be understood from Table 6.

Procedure. The participants were invited to take part in the experiment. The participants were asked to sit comfortably and told that they would be participating in an eye-tracking experiment in which they would have to read a few statements and view some images. Before starting experiment, their written consents have been taken. The participants were then calibrated to the eye tracker and then asked to hold their seating position for the duration of the experiment. The participants were asked “please look at the screen throughout the experiment and not look away at any point during the experiment”. The images slides with information/blank slides were shown

to the participants, followed by image slides accompanying positive/negative information slides after which the image slides of familiar and unfamiliar actors were shown. After all images were shown, the participants were thanked, they were debriefed about the experiment and given compensation of Rs.100 for their participation.

Results

Table 7 shows the main effect of the actor's physical characteristics and the actor familiarity. It also shows the interaction between the body and face of the actors and the familiarity of the actors to the participants. It is found that the participants view the faces of the actors significantly more than the body of the actors $F = 7.387, p = .010$. The table also shows that the unfamiliarity of the image causes an increase in fixation time of the participants with marginal significant $F = 4.032, p = .052$. In the interaction analysis, it is found that the participants viewed the face of unfamiliar actors significantly more than their bodies, whereas there was no difference between the face and body of the familiar actors $F_{(1,36)} = 33.073, p < .001$. Figure 5 shows the main effect of the physical characteristics of the actors and the type of actor that was shown. There is a gap we see in both the main effects; the face of the actor is seen significantly more than the body. On the other familiar actors are seen more than then the unfamiliar actors but not to a significant degree.

Table 7

Interaction effect between actor physical characteristics and actor types

| Pair | Images | Mean | SD | F | Sig. | η_p^2 |
|-------|--------|-------|-------|-------|------|------------|
| Actor | Face | 1.025 | 0.372 | 7.387 | .010 | 0.166 |
| | Body | 0.721 | 0.360 | | | |

| | | | | | | |
|------|------------|-------|-------|--------|-------|-------|
| Type | Familiar | 0.959 | 0.301 | 4.032 | .052 | 0.098 |
| | Unfamiliar | 0.786 | 0.283 | | | |
| Body | Familiar | 0.947 | 0.571 | 33.073 | <.001 | 0.472 |
| | Unfamiliar | 0.494 | 0.381 | | | |
| Face | Familiar | 0.972 | 0.458 | | | |
| | Unfamiliar | 1.078 | 0.475 | | | |

#N=38 for each pair

Figure 5. Main Effect of Physical Characteristics and Actor Type

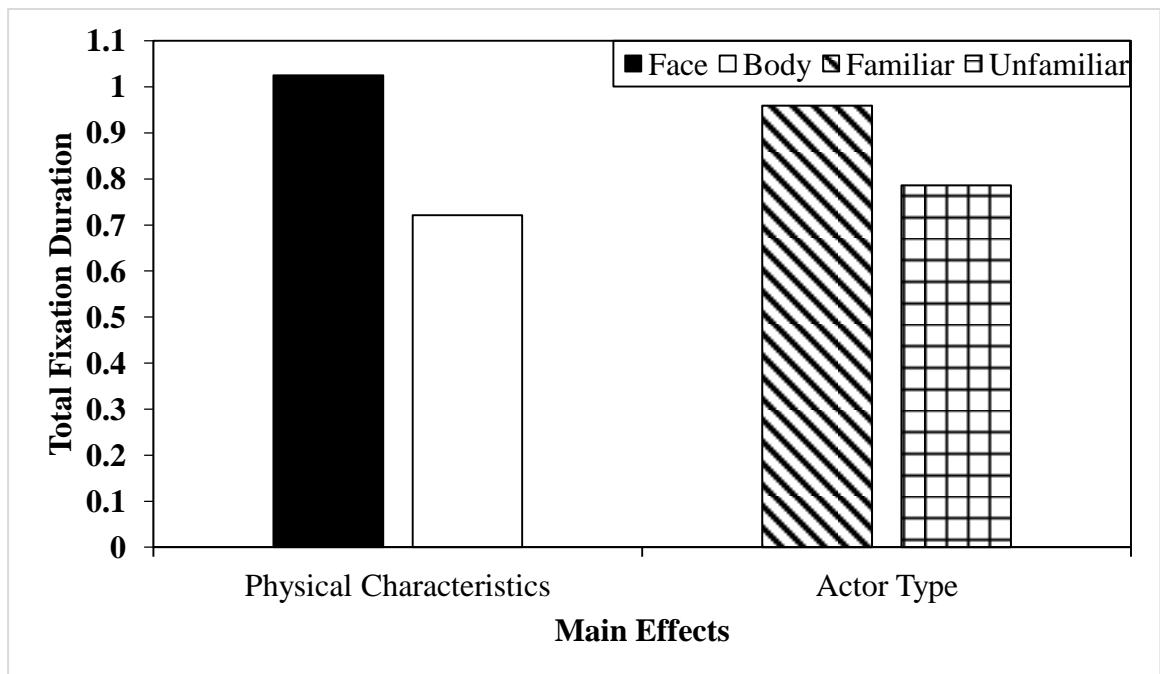


Figure 6. Interaction Effect of Physical Characteristics and Actor Types

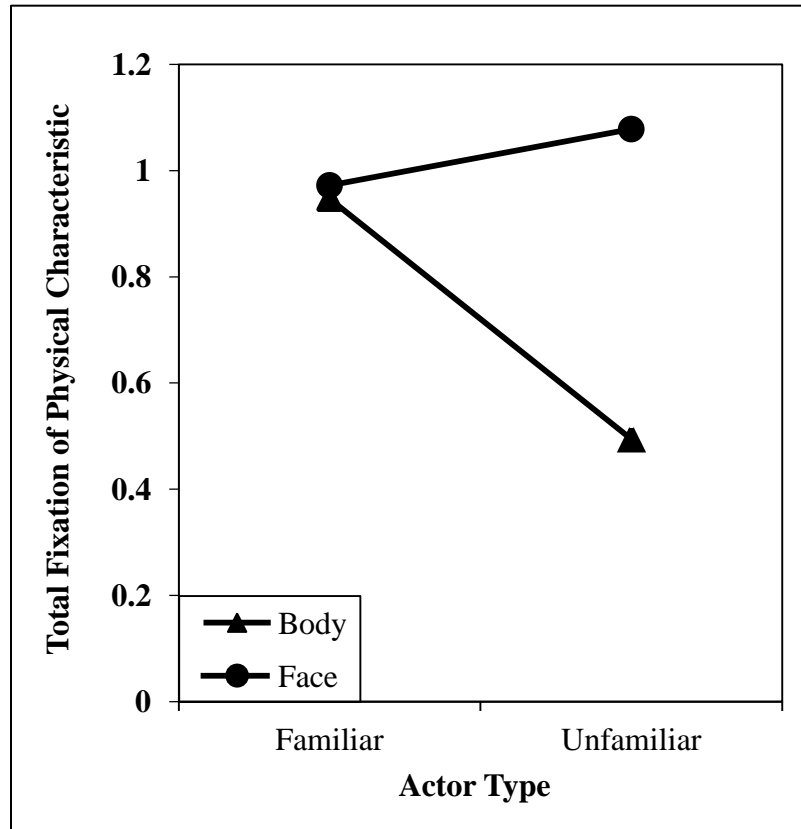


Figure 6 shows the interaction effect between body/face of actors and familiar/unfamiliar of actors. Clear differences can be seen between how the image characteristics are viewed by the participants differently for familiar actors when compared to unfamiliar actors. There is a significant gap between face and body of the unfamiliar whereas there is no gap between familiar face and familiar body.

Table 8

Paired t-score between special image characteristics

| Images | Mean | SD | t | Sig. | d |
|------------|-------|-------|-------|------|-------|
| Action | 1.979 | 0.323 | 2.827 | .008 | 0.459 |
| Non-Action | 1.767 | 0.278 | | | |
| Old Age | 2.018 | 0.368 | 3.279 | .002 | 0.304 |
| Young Age | 1.735 | 0.343 | | | |

#N=38 for each pair

Paired t analysis between specific actors characteristics (age and action) are given in table 8. Participants viewed the action images significantly more than non-action images $t_{(37)} = 2.827$, $p = .008$. They also viewed the non-referential images (images showing actors older than them) significantly more than self-referential images (images showing actors similar ages to them) $t_{(37)} = 3.279$, $p = .002$. Figure 7 presents the fixation duration difference between action and non-action images, there is a clear difference seen in the graph. The same clear difference is seen in the age image characteristic where old aged images are viewed significantly more than young aged images.

Figure 7. Total Fixation Duration of Active Pair and Age Pair

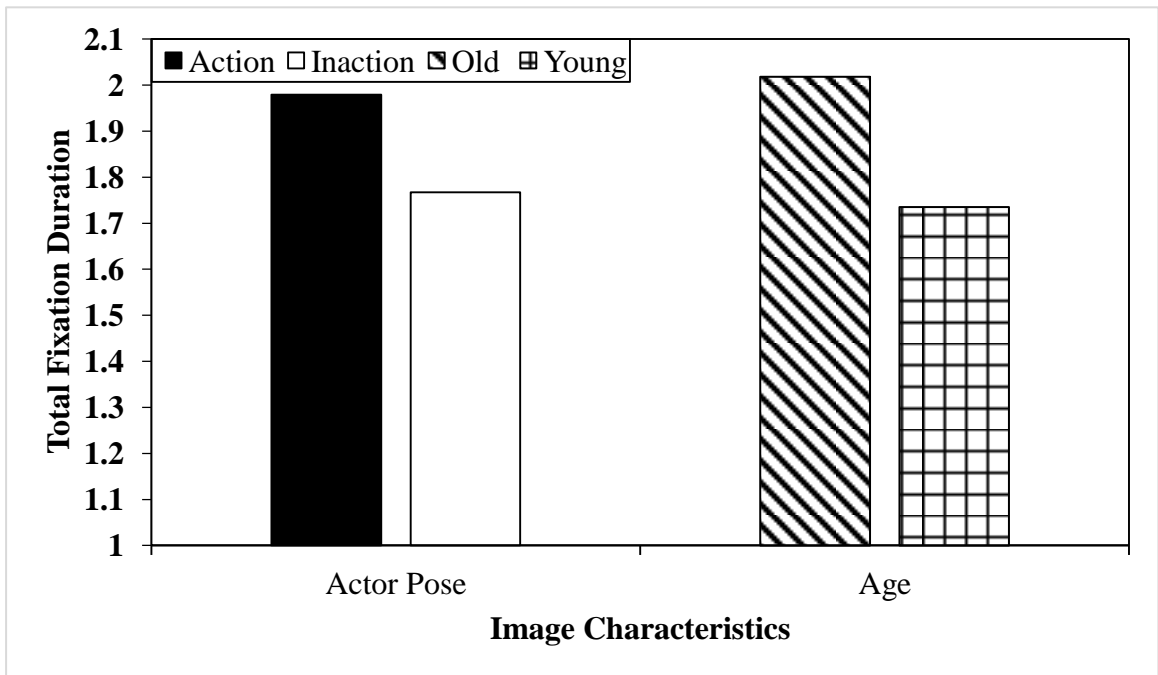


Table 9

Differences between different types of information

| Images | Mean | SD | t | Sig. | d |
|----------------------|-------|-------|-------|-------|-------|
| Information | 2.087 | 0.344 | 3.860 | <.001 | 0.626 |
| Blank | 1.735 | 0.336 | | | |
| Positive Information | 1.798 | 0.290 | 1.454 | .154 | 0.236 |
| Negative Information | 1.894 | 0.295 | | | |

#N=38 for each pair

Table 9 shows the differences in fixation time due to the different types of information given before the image of the actors. It reveals that when the participants were shown information/blank slides, participants viewed the images of the actor corresponding to the information side significantly more than blank side $t_{(37)} = 3.860$, $p < .001$. However, when participants shown positive/negative information slides, such

information had no significant effect upon the fixations on actor's image for which the information was given $t_{(37)} = 1.454$, $p = .154$. Figure 8 shows graphs of information characteristics. In the first one we see the presence of information is significantly higher than blank. In the second graph there is no clear difference between the two information types i.e. there is no gap between positive and negative information.

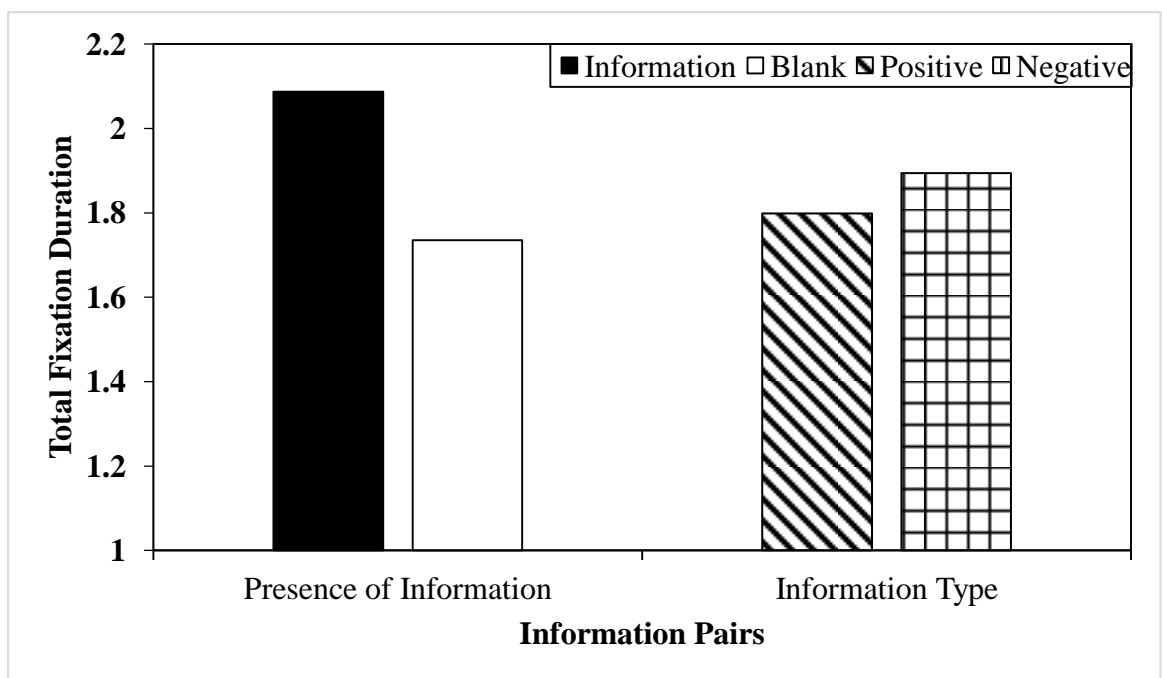


Figure 8. Total Fixation Duration of Information Pairs

CHAPTER 5: DISCUSSION

Impression formation is an integral part of an individual's social life, and it affects their attitudes and behaviours. Eye movements are a major biological phenomenon that are influenced by a person's behaviour and attitude (Yarbus, 1965; Duchowski, 2005). Hence one can say that impression formation probably influences eye movements of individuals. Decades of research on impression formation were based on self-report and observation, though recently measures such as brain scans etc. are being used. Majority of research in impression formation using eye movement as a measure, use only the facial region as a stimulus and not the whole body of the person. In this research, the whole person is shown as stimulus rather than just the facial region. Therefore, to study the effects of how the inclusion of the body might cause a change in eye movements when performing impression formation.

It was hypothesised that the face would be seen significantly more than the body when the participants were shown the whole person rather than only the during impressions formation. Results of the first study show the participants were provided one of two instructions - impression and free look. It was seen that participants in the impression condition viewed the faces of actors significantly more than the body of the actors compared to free look instructional condition, which supports our assumptions and is also supported by prior studies (Fukuyama et. al., 2002; Janik et. al., 1978; Kendon & Cook, 1969). In the second study participants were shown image slides with familiar and unfamiliar actors, where unfamiliar actors trigger impression formation (Idson & Mischel, 2001). The result of the second study supports this hypothesis as participants were seen to have viewed the faces of the unfamiliar actors

significantly more than the body, while there is no difference in face or body when participants viewed the familiar actors.

The second major assumption of this research was that there would be a difference in how the participants would view the images of actors in action or non-action. It was hypothesis that action images would be seen more as they would garner more interest due to their inherent characteristics. Which has been supported by both the studies in this research, as both studies had action and non-action in the same image to compare how its effects. Participants viewed the actors who were performing actions significantly more than actors who were inactive. The finding supported by the past research on how people view action or non-action (Borji & Itti, 2014; Greenlees et. al., 2005; Greenlees et. al., 2008).

Two hypotheses were based on prior research related to self-referential stimuli and their effects on eye movements judgement (Leshikar, Cassidy & Gutchess, 2015; Kristof-Brown, Barrick & Franke, 2002). One of them was based on that participants would view self-referential stimuli more than non-referential, the other was self-referential actors would be given a more positive rating. Results of both the studies do not support the hypotheses. The first study results show that participants did not view self-referential actors (in this case gender of the actor) more than non-referential, as well as self-referential actors were not given a more positive rating compared to non-referential. The second study presented an opposite trend to the assumption, the results show that the participants viewed the non-referential actors significantly more than referential actors (in this case age of the actor). The results are inconclusive and need further exploration.

The second study's major component was the presentation of information about the actor before they were shown the images of the actors. It was hypothesised

that participants would view images following information more than images that are not accompanied with the information. The information/blank slides comparison supports this hypothesis. Results show that the participants viewed the images following information significantly more than images that followed the blank side of the slide. These results follow findings of prior studies where the information changed the eye movements of the participants. However, those studies had the information presented in the same slide as the image (Adaval, Isbell & Wyer, 2006; Bar, Neta & Linz, 2006; Kunda & Thagard, 1996; Locksley et. al., 1980; Paunonen et al., 1999; Sneft, Chenosa-Dutton & Patten, 2016). The present study shows that the information given beforehand may influence the way we see the actors.

The final hypothesis based upon the assumption that negative information followed images would be viewed more than positive information followed images. The results show that there is no significant change caused by the polarity of the information on the viewing time of actor images. The cause of not having any change due to the negative/positive information, could be that when the actors were easily accessible to the participants i.e. they view their photos of the actors the polarity of the information is being controlled; this phenomenon has been shown in prior studies (Ruva, Guenther, & Yarbrough, 2011; Vonk, 1996). The results show that negativity bias may diminish if negative information is provided with image of the actor during the impression formation.

Conclusion

The present research examines the effects of impression formation on eye movements. It tries to understand how the act of impression formation in conjunction with various verbal and non-verbal visual cues can cause changes in eye movements of the participants who are looking at the cues during the act. This thesis shows that there is an effect of impression formation on eye movements specifically how they cause participants to face of the actors significantly more than the body in images. It also shows that when there is action in the image participants will view action significantly more with or without forming impressions. Finally, information i.e. statements specific to stimuli makes the participants view those stimuli significantly more than those stimuli that were not presented with information.

Limitations

The use of fixation duration as a sole indicator in the understanding of participants eye movements is a major limitation of this research. The use of other methods such as saccadic movement and scan pathing could yield in specific movement patterns in how participants view images under the instruction of impression rather than an overall time-based pattern. The use of nonstandard images is another limitation, as it may hinder the replicability of studies in other situations. There was no measure used in the second study to check impressions of the participants to confirm whether impression formation was occurring during the experiment.

Future direction of research

The future research in this line could help to overcome the limitations of the present research. Using multiple types of eye tracking measures, mainly scan pathing to find out how the participants scan during impressions. Additionally, the use of a

more robust impression measurement to gauge the impressions, also an impression measurement that can be used in conjunction with short experimental conditions as to not make the participants bored during the experimental process would let us confirm and contrast participant impressions. The use of more polarising information than currently used would give a more clear and distinct differences between the negative and positive information. Further investigation can be done on self-referential and non-referential characteristics, using a more referential characteristics than currently used in this research and finding a more diverse result.

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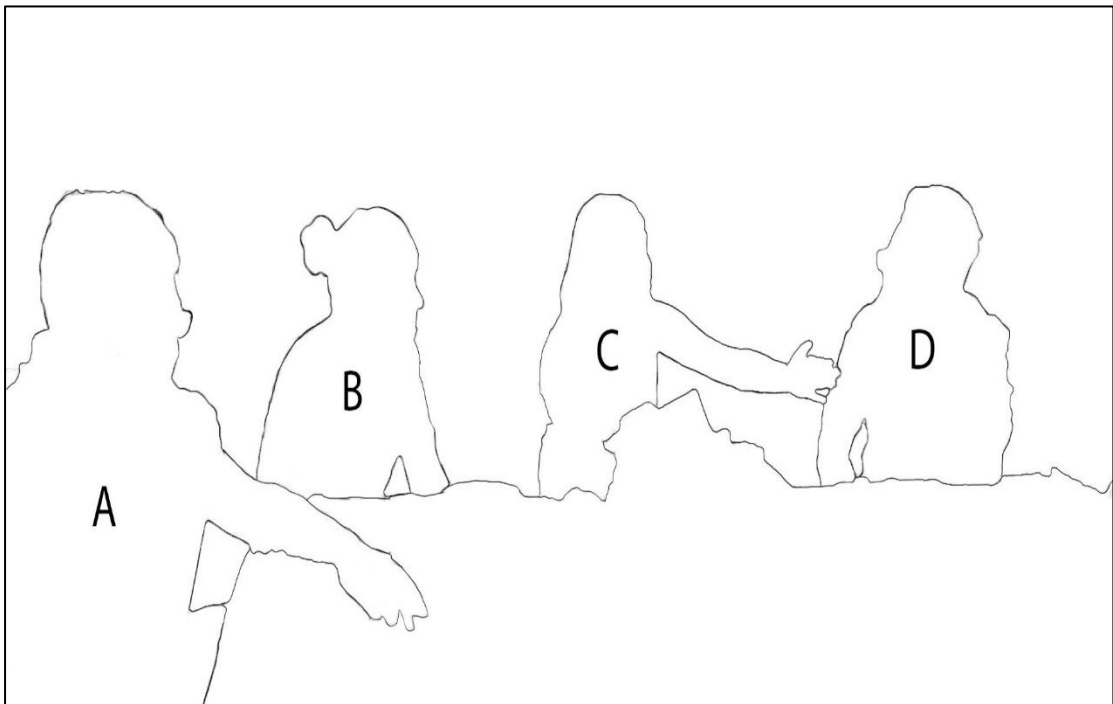
Yarbus, A. (1967). *Eye movements and vision*. Boston, MA: Springer (originally published in Russian 1962). <https://doi.org/10.1007/978-1-4899-5379-7>

APPENDIX A



A1. Image shown in the First Study

Faces of the actors are blurred to keep their identity hidden. The faces were shown during the experiment



A2. Outline of the Actors used for Impression Formation

Rate the people you saw accordingly based on the scale that is provided below.

| A | | B | | C | | D | |
|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|
| Honest | Dishonest | Honest | Dishonest | Honest | Dishonest | Honest | Dishonest |
| Trustworthy | Untrustworthy | Trustworthy | Untrustworthy | Trustworthy | Untrustworthy | Trustworthy | Untrustworthy |
| Tolerant | Prejudiced | Tolerant | Prejudiced | Tolerant | Prejudiced | Tolerant | Prejudiced |
| Friendly | Hostile | Friendly | Hostile | Friendly | Hostile | Friendly | Hostile |
| Compliant | Uncompliant | Compliant | Uncompliant | Compliant | Uncompliant | Compliant | Uncompliant |
| Reliable | Unreliable | Reliable | Unreliable | Reliable | Unreliable | Reliable | Unreliable |
| Helpful | Unhelpful | Helpful | Unhelpful | Helpful | Unhelpful | Helpful | Unhelpful |
| Polite | Impolite | Polite | Impolite | Polite | Impolite | Polite | Impolite |
| Sincere | Insincere | Sincere | Insincere | Sincere | Insincere | Sincere | Insincere |
| Genuine | Deceitful | Genuine | Deceitful | Genuine | Deceitful | Genuine | Deceitful |
| Hardworking | Procrastinating | Hardworking | Procrastinating | Hardworking | Procrastinating | Hardworking | Procrastinating |
| Humble | Prideful | Humble | Prideful | Humble | Prideful | Humble | Prideful |
| Careful | Careless | Careful | Careless | Careful | Careless | Careful | Careless |
| Generous | Greedy | Generous | Greedy | Generous | Greedy | Generous | Greedy |
| Considerate | Inconsiderate | Considerate | Inconsiderate | Considerate | Inconsiderate | Considerate | Inconsiderate |

A3. Impression Scale used in the First Study

APPENDIX B



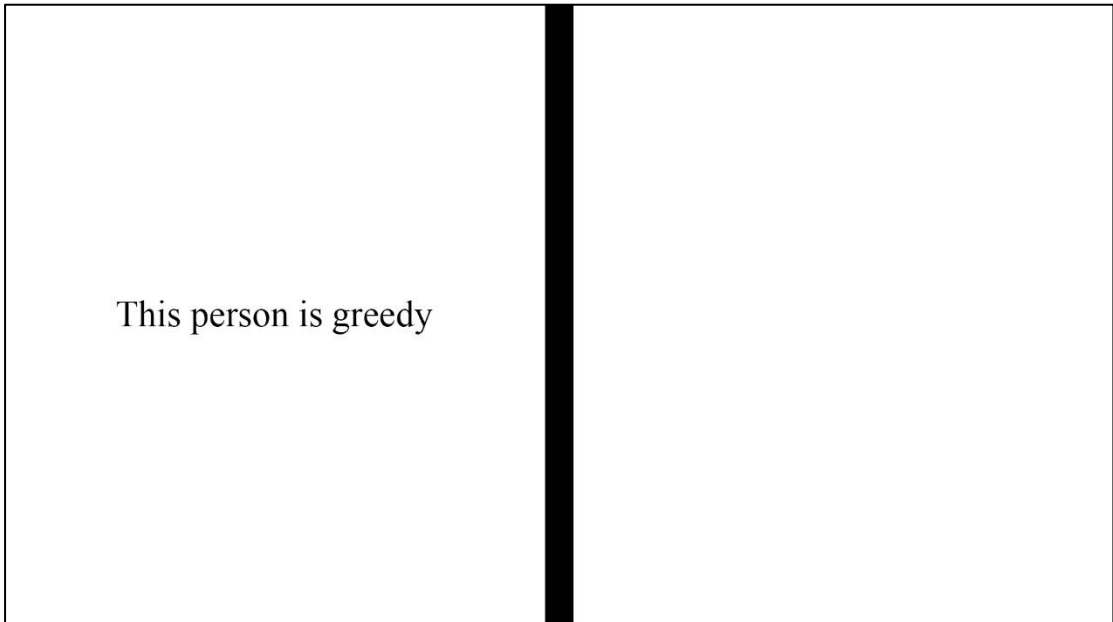
B1: Image Slide used in the Second Study (Both Sides Unfamiliar)

Faces of the actors are blurred to keep their identity hidden. The faces were shown in during experiment

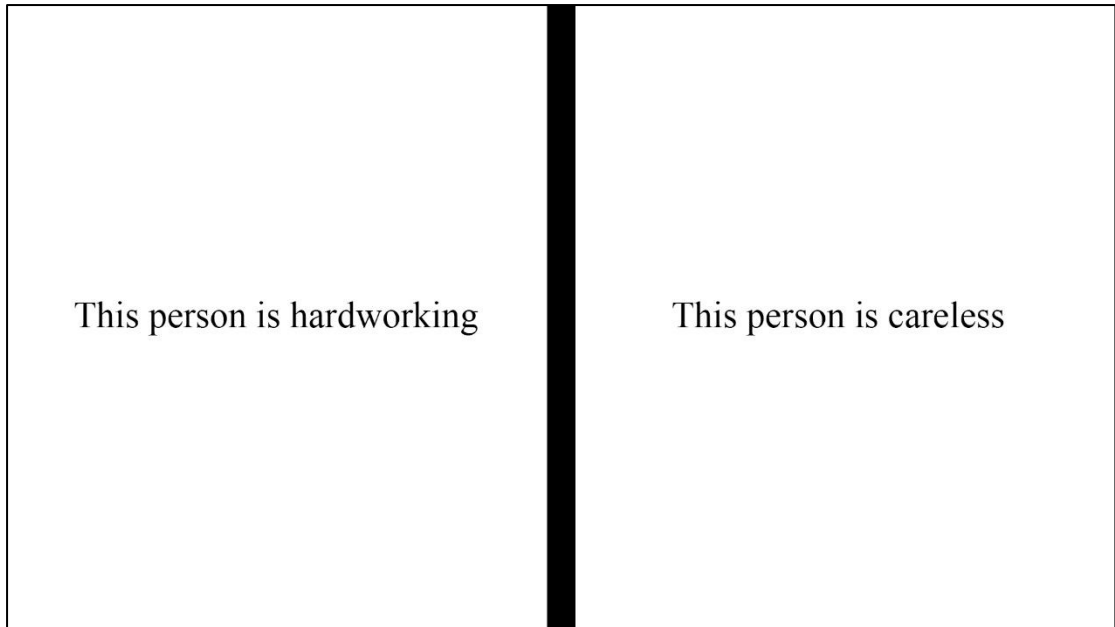


B2: Image Slide used for Second Study (Unfamiliar and Familiar Actors)

Faces of the actors are blurred to keep their identity hidden. The faces were shown during the experiment



B3: Information Slide used in Second Study (Information/Blank)



B4. Information Slide used in Second Study (Information on both sides)