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Video Responsiveness: Reactive Awareness in Motor Function

G. Adam Martz¹³

This is a research proposal for a study on the empathetic imitation of models on television. Imitation as an extension of social conformity and learning through mimicry is one of the deepest assumptions of modern social-psychological theory. There has been much evidence in recent years to support that mirror neurons, the biological factor that allows human and ape brains neurologically interpret and incorporate the actions of others, are situational in what actions they empathetically attempt to encode (Hodges, 2014; Subiaul, 2016). Previously, empathetic imitation was thought to occur only through interactions but in recent years several studies have established that more important than one's part played in a learned experience is one's perception of it (Feshbach & Feshbach, 1997; Stel & Vonk, 2009). We are imitating skills modeled by distant or fictional characters when we watch television without noticing it and therefore are learning everything from simple facial expressions to complex motor skills in an artificial environment. In this study, I will evaluate the limitations of this process by attempting to produce imitative motor movement in participants that are complex and specific. I will be showing participants videos with varying levels of writing or drawing modeled in them to establish videos with higher frequencies of this trait producing higher levels of motion from participants watching.

It is often said that experience is the best teacher. What some may fail to realize is that experiences can occur not only by actively participating but rather also by merely witnessing an event repeatedly (Subiaul, 2016). Empathetic imitation, or imitating another to empathetically bond with them, has long been a cornerstone of social psychological theory (Hodges, 2014). Though engaging in a behavior does yield more learning than simple observation, the nature of the mechanisms behind empathetic imitation, automatic mimicry, and muscle memory leads to a moderate yield in retention (Sonny-Borgstrom, 2002). Human beings as a species learn incredibly well from observation due to our capacity to empathetically apply

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the experiences of others with ourselves in mind.

It was not until relatively recently that the biological method by which this learning occurs was discovered. The human brain, as well as the brains of more evolved species of ape, contains a circuitry of “mirror neurons” or neurons that assist in the mapping of visually obtained information into the motor cortex (Iacoboni, 2009; Subiaul, 2016). Mirror neurons do not retain just any visually obtained information but rather specifically those that incorporate the movements and behaviors of other living creatures. It is a biological advantage to be able to evaluate the actions taken by another within the scope of attempted replication. This allows us to receive similar results in the case of an observed desired response or to avoid repeating actions doomed to fail in the case of an observed unfavorable reaction (Rizzolatti, Fogassi, & Gallese, 2001).

Empathetic imitation is closely associated with, but not limited to, two distinct levels or modes of mimicry. The first of these is facial imitation and is maintained through a process called “facial feedback.” In this process, the meaning behind a facial movement is discerned and the behavior is copied through an automatic response (Leslie, Johnson-Frey, & Grafton, 2004). This in turn causes us to experience the corresponding emotions and empathetically link not only our actions with those that we observe but also our emotional states in a loop with the potential to spread from person to person in a manner that is not unlike a contagion (Feshbach & Feshbach, 1997).

The second most common mode of automatic imitations are those associated with motor movements which are broken up further into simple motor movements and complex motor movements. Simple movements like squeezing or grabbing are those movements that can be enacted quickly and simply. Complex motor movements are those that require continuous

movement and must be chained with other movements to perform a process such as walking or writing. These movements are imitated at a much subtler level through an execution-operation matching system. While still empathetic in nature, these movements are often imitated to learn or maintain skills rather than to empathetically bond with the observed (Fadiga, Fogassi, Pavesi, & Rizzolatti, 1995).

To what extent does automatic mimicry pertain? Recent studies suggest that our capacity to learn by observing is not limited only by our ability to naturalistically observe but also by our perception. In two studies involving the attempt to direct emotions through facial feedback, the ability to empathize with an imitated facial feature seems to be diminished when the target feature is known to be false (Feshbach & Feshbach, 1997; Stel & Vonk, 2009). Furthermore, the ability to imitate willingly and actively is also reduced due to a break in a facial feedback loop causing viewers who perceive a face as false to misinterpret its true intended meaning and therefore imitate incorrectly due to lowered empathy (Leslie et al., 2004).

Although it is not necessary for a witnessed action to be made by another human for the average person to initiate automatic mimicry, imitation becomes more likely when the target behavior is performed by the observer's conspecifics due to the naturalistic increase in potential empathy due to shared ground (Subiaul, 2016). Also, a witnessed behavior's temporal or spatial relativity to the viewer does not seem to affect the likelihood of imitation (Feshbach and Feshbach, 1997). Because of these colliding factors, the potential to empathize with figures on a screen without interacting with them is made available. A person can watch the actions of an individual on a screen that they have never met or that may be completely fictional, and potentially learn through imitation new skills exhibited by the figure. A boom in various forms of popular and mass media recently has increased the opportunities one has to observe and therefore

learn from these non-traditional sources, making this process much more relevant to understand than in past years.

In recent years, the playing of video games has become a more likely pastime in a larger percentage of households (Entertainment Software Association, 2017). Steadily advancing technology combined with the industries ambitious desires to improve their products has led to a surge of interest into the psychological basis of these mediums potential to succeed. An increasingly relevant goal in the field is to deepen the consumers empathetic connection with both fictional characters and characters that are digitally created imitations of realism (Morrison and Ziemke, 2005). This in turn has led to another crucial aspect of how mirror neurons and empathetic imitation operates. Research evaluating the extent of automatic reactions, while playing video games in a simulated environment using eye-to-body-representation, finds a tendency for players to have increased spatial presence with regards to a character. This is the potential for one to hyper-focus on a digital display and begin both perceiving a digital environment as their own and reacting to such an environment on a physiological level (Wissmath, Weibel, & Groner, 2009). As behaviors are being mirrored not only of an artificial representation of a “person” but also of one that is under the control of the observer, this is a rare environment where a feedback loop similar to facial feedback but in the realm of motor imitation is presented (Morrison and Ziemke, 2005).

Similarly, studies in recent years have sought to evaluate the roll of empathetic imitation with regards to the medium of watching television. Positive associations have been found supporting that facial feedback in children imitating the movements of faces on a screen imparting information to them. For example, children may co-align their emotional responses appropriate to the facial expressions of a news reporter. (Feshbach and Feshbach, 1997). One of the reasons fictional films can be so emotional, despite one’s intimate knowledge that the events

displayed never occurred, is due to the viewers tendency to imitate the faces of witnessed actors. Good actors so accurately portray the emotions that a scene in a movie is meant to exhibit, that when a viewer imitates the face they see, they feel the associated emotions strongly despite the lack of authenticity in the expressed emotion (Wood, Rychlowska, Korb, & Niedenthal, 2016).

I intend to continue this trend of research by evaluating the existence and role of complex motor movement imitation within the medium of television. Very little research exists suggesting the outcome with regards to imitation when a matured individual watches a fictional movie or show. Will the viewer imitate complex motor movements to a level recognizable to a watchful eye? Does the knowledge that what they are watching is fictional impede their ability to imitate empathetically? Does the target behavior need to be in the foreground or do we pick up on the behaviors of a wide variety of background models as well? Do only intense movements produce a noticeable imitation or do subtle or specific movements produce one as well? I intend to answer these questions through this study. I will be showing college students multiple videos of modeling the specific motor movement of writing to see if this complex motion is imitated. Each video provides an example of different durations and intensities of writing. I hypothesize that participants that watch characters on a screen write or draw will automatically imitate these observed movements while holding a pen to paper.

Furthermore, I am interested in evaluating if there is a difference between the scores of those who engage commonly in activities that would trigger empathetic imitation and those who do not. Using a demographic questionnaire, I would attempt to examine the descriptive statistics of participants for a difference in scores. I expect those who report commonly engaging in leisure activities that include interacting with or watching other people will have higher levels of imitation.

Method

Participants

All participants would be volunteers, ages 18 through 29 as this is a demographic consistently found to have the highest exposure to the types of media I am most interested in studying, and therefore arguably most susceptible to their effects. Among subjects, there would ideally be an equal number of participants who self-identified as male as participants who self-identified as female to provide the most generalizable results. I expect a significantly larger number of participants to self-report being right-handed than those who self-report being left handed as this would also represent the population to which I would like to generalize my findings.

Materials

An informed consent form will be used to explain the procedures that participants would undertake if they continued, the purpose of the study, the risks and benefits of participating, and the contact information of the researchers (See Appendix A). A survey on demographical background and leisure time usage modified from an existing survey found online will be used to gather data relating to the study from participants (See Appendix B). A standard #2 pencil and a blank sheet of 8.5 in. by 11 in. paper will be utilized in the tests. The experiment will take place in a small room with one table, and one chair. On the table is a homemade box which will be utilized to block participants hands from their view (See Appendix C). On top of the box there will be a computer screen to display videos.

Two recording cameras in the room will record movements made while the box covered the hands of participants and the screens the participants would watch to assure movement was in reaction to specific prompts on screen. One of the cameras will be aimed directly at the viewer from behind the screen of the computer and the box, angled to have a clear

view of the participants hands with their face obscured by the screen. The other camera will be positioned behind and to the right the participant with a clear view of the computer screen unobscured by the participants head.

Four videos (See Appendix D) would be used. The first video is a control video with no target behavior. The second video features primarily background writing with predictable periods of heavy foreground writing. The third video displays aggressive drawing with erratic movements. The fourth video features only foreground writing with slow elegant strokes.

Procedure

Upon entry to the trial location, all participants will be given an informed consent sheet informing them that they will be participating in a study on reactiveness to visual stimuli that involves holding objects in a box that blocks vision of their hands and watching a short video. All participants that signed and accepted the terms of use were then given a demographic survey meant primarily to discern the amount of time they spend engaging in certain leisure activities that foster a healthy level of imitativeness. All participants will be asked to remove any jewelry on their hands to help reduce fatigue as well as to prevent recordings of their hands from being identifiable. Participants will then begin participating in several trials that make up the remainder of the experiment.

In the trials, participants will be asked their dominant hand and then told to “start holding the pencil to the paper with a relaxed grip using that hand.” Participants will not be told to make motions with their hands nor will they be discouraged from making movements. Neutral language shall be used so as not to imply the researcher’s intention towards results. Participants should then have the box be placed over their hands to prevent any movement they might make from distracting them from the video they would be about to watch. Their hands would then both covered by the box. The video recorder will be turned on in sequence with the

video beginning to provide an alignment in the time stamps of the video and the hand recording. The order of videos watched would be randomized to prevent confounds.

Regardless of the order of the target videos, all participants will watch a short film that does not include any recognizable characters writing or drawing in it first (See Appendix D). This video includes a scene of a character with hands placed into a box like the ones participants have their hands in at this point. It is meant to mislead the viewer by firstly suggesting some greater importance to the box and drawing attention away from the target motion of writing or drawing. Participants would then watch one of three random target videos each with different variations of the target hand movement of drawing or writing. Video recordings of the participants hands verify the start time, finish time, and any intermittent time of any and all motion made by the hand holding the pencil. After the trial, the times of movement will be documented as well as the width of any markings made on the paper measured between the two points most distant from each other. Participants will then be given a debriefing letter informing them about the true nature of the study (See Appendix E). Afterwards, any questions they may have will be answered and they would be free to go.

Expected Results

After data is collected, I would then run several tests to evaluate the results. I am hypothesizing that the independent variable of “shown video” would affect the dependent variable; the amount of writing motion the participant exhibited. The null hypothesis that I would then be testing would be that the variable of shown video would not affect the amount of writing the participant exhibited. I would test this by performing a one-way ANOVA and comparing the means of the amount of writing exhibited under the four levels of the independent variable. These means measure the length between the longest points from the center starting point during each specific trial and as a result are a measure of the physical intensity of imitation.

I would also like to run a one-way ANOVA on the four means of “duration of movement” measured by evaluating recordings of participants hands to determine how much time they spent moving them over the course of the observed video. This would give me a measure of the temporal intensity of the imitation. I would also like to run a *t*-test for independent samples to determine if there is a difference between gender and both physical and temporal imitation. Then I would use descriptive statistics to determine if handedness affected the likelihood of imitation in my sample. Lastly, I would tally the points in the leisure-time activity survey and determine each individual score for engaging in activities that foster imitativeness and run a correlational analysis with their scores in both physical and temporal analysis.

Discussion

Of the three levels of empathetic imitation, I believe complex motor movements to be the most difficult to reproduce results for. As they are the most specific in their criteria and occur at much more subtle levels than other types of imitation, results of any level of significance using my current methods may be difficult to achieve (Rizzolatti et al., 2001). My initial versions of this study included notions of doing fewer trials per a participant but rather more varied trials that encompassed a wider range of empathetic imitation types. In the end, I determined it was better to evaluate the extent of imitation from the most unexplored mode.

Empathetic imitation happens unconsciously and so often presents itself as a twitch or subtle movement. The more complex the movement, the less intense the imitation would be. Furthermore, it is held back by personal knowledge of the imitation (Rizzolatti et al., 2001). It was for this reason that I developed the concept of the box. The hope was that, with the participants hands being blocked from vision, participants would move more before consciously realizing they were moving therefor by stopping themselves.

If this study provides results, the logical next step would then be to move backwards towards the more simple and familiar modes of imitation. In the future, I would like to modify my protocols outlined here to both the imitation of simple motor movements and facial imitation. The imitation of simple motor movements could be evaluated under the circumstances of participants holding a clay ball while watching a model squeeze a stress ball. In such a study, I could measure the intensity of the imitation by the depth of any dents left in the clay ball. For facial imitation I would have liked to replicate the study made by Wood et al. (2016) where a screen was displayed with a model displaying several rapidly changing expressions to establish which expressions were copied easier.

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Appendix A

Informed Consent Form
Research Study Consent Form
 Reactive Awareness in Motor Function

Before reading this consent form, please know:

- Your decision to participate is your choice
- You will have time to think about your study
- You will be able to withdraw from this study at any time
- You are free to ask questions about this study at any time

After reading this consent form, we hope you know:

- Why I am conducting this study
- What you will be required to do
- What are the possible risks and benefits associated with this study
- What to do if you have questions or concerns associated with this study

Basic information about this study:

- I am interested in learning about general responsiveness to visual stimuli made while watching television.
- Risks of participation include hand fatigue due to extended holding periods and possible dissatisfaction with the scenes you see.

Page Break

Research Study Consent Form
 Emulative Responsiveness in Motor Function

You are being asked to participate in a research study being conducted by Adam Martz under the guidance of Michiko Nohara-LeClair at Lindenwood University. Being in a research study is voluntary, and you are free to stop at any time. Before you choose to participate, you are free discuss this research study with family, friends, or a physician. Do not feel like you must join this study until all of your questions or concerns are answered. If you decide to participate, you will be asked to sign this form.

Why is this research being conducted?

I am performing this study to examine the connection between observing others and automatic motor responses. I will be asking about 45-60 other people to participate as well.

What am I being asked to do?

You will be asked to hold a pencil to a paper and then will have a box placed over your hand to block your vision of it. You will then be asked to watch a short (2-3) minute video. You will then be given a short break before being asked to do the same thing twice more with other videos.

How long will I be in this study?

I anticipate that this study will take roughly 20-25 minutes.

Who is supporting this study?

This study is being independently funded by the researcher.

What are the risks of this study?

- Privacy and Confidentiality
We will be collecting information that could be used to identify you until it is de-personalized. Your hands inside the box will be recorded for the purposes of viewing any reactions you make. Once those actions are viewed, they will be recorded by writing and this written description of your movements will take the place of the video recording in our data.
- Fatigue
Holding a pencil for an extended period may cause muscle fatigue in the hand.
- Content
As each person's interests and desires regarding entertainment varies, you may potentially find the scenes you see unfavorable. You may perhaps not like the show or movie the scene is from. You may perhaps not want plot points of a show or movie you have not yet seen "ruined."

What are the benefits to this study?

You will receive no direct benefit for assisting in this study. We hope that what we learn may benefit other people in the future.

Research Study Consent Form

Emulative Responsiveness in Motor Function

Will I receive any compensation?

To thank you for taking part in our study, you will receive 3 LPP credits after you take this study.

What if I choose not to participate in this research?

It is always your choice to participate in this study. You may withdraw at any time. You may choose not to answer any questions or perform any tasks that may make you feel uncomfortable. If you decide to withdraw, you will not receive any penalty or loss of benefits. If you would like to withdraw from the study, please let me know as soon as possible.

What if new information becomes available about the study?

During the course of this study, we may find information that could be important to you and your decision to participate in this research. We will notify you as soon as possible if such information becomes available.

How will you keep my information private?

We will do everything we can to protect your privacy. We do not intend to include any information that could identify you in any publication or presentation. Any information we collect from you will be stored by the researcher in a secure location. The only people who will be cleared to see your data are: members of the research team, qualified staff of Lindenwood University, and representatives of state or federal agencies.

How can I withdraw from this study?

Notify the researcher immediately if you would like to withdraw from this study.

Who can you contact with questions or concerns?

If you have questions about your rights as a participant, or concerns about the study, or if you feel under any pressure to enroll or continue participating in the study, you may contact the Lindenwood University Institutional Review Board Director, Michael Leary, at (636) 949-4730 or mleary@lindenwood.edu. You can contact the researcher directly at (314) 566-5774 or gam754@lindenwood.edu. You may also contact Michiko Nohara-LeClair at mnohara-leclair@lindenwood.edu.

I have read this consent form and have been given the opportunity to ask questions. I will also be given a copy of this consent form for my records. I verify that I am at least 18 years of age or have a parental consent form filed with the LPP office. I consent to my participation in the research described above.

<hr/> Participant's Signature	<hr/> Date
<hr/> Participant's Printed Name	

<hr/> Signature of Principal Investigator or Designee	<hr/> Date
<hr/> Investigator or Designee Printed Name	

Appendix B

Demographic and Leisure Usage Questionnaire

Please list your current age. _____

Please circle the gender you most self-associate with. **Male** **Female** **Other**

Please circle your dominant hand. **Right** **Left** **Neither**

Please check the frequency in which you engaged in the following **leisure activities** in the past two months. Check only one answer for each possible activity.

	Frequently	Occasionally	Seldom	Never	Not sure
Watching television					
Playing board games					
Playing video games					
Walking for pleasure					
Reading books for pleasure					
Competing in physical team sports					
Going out with others for drinks and entertainment					
Going to the movies					
Listening to music					
Surfing the Web					
Attending sports events					
Competing in individual sports					
Collecting or making something					

Appendix C
Box Apparatus



“The Box”

The box is a cardboard box cut, covered in duct tape for stability. Its dimensions are 22” long by 13” wide by 9” tall which is tall enough to give ample room for movement of a hand holding a standard 6” long pencil while being wide enough for the average 8 ½” by 11” piece of paper to fit in. On one side there are two 4” by 4” holes, 4 ½” from either side of the boxes edge. This gives plenty of room for hands to comfortably fit in and arms to rest without being scraped by even an exceedingly tall participant. On the back are two small holes, one on each side of the box, to fit through an apparatus meant to start, pause, and stop video recording. Inside is a holster to hold an iPhone 6 and a light source to illuminate the inside of the box allowing for proper capture of motion. Light escaping the box is minimized by streamers attached to the top of the hand holes.

Appendix D

Description of “The Videos”

The first video serves several purposes at once. Firstly, its tonality is significantly less light hearted than the rest of the scenes by design. By starting with a video that elicits adrenaline and attention, I hope to both interest the viewer and put them in a state more conducive to the goal of fostering future imitation. It is from “House M.D.” Season 6, episode 4, titled “The Tyrant.” Though it is a video without writing, it justifies its use over other writing-less videos by assisting in misdirecting participants. It features a character with a missing hand being forcefully subjected to “Mirror Box Therapy,” a form of therapy that uses a box that obscures one’s hands reminiscent but not identical to the box used in my experiment. Due to its content, it is also meant to mislead the viewer by distracting them from the writing aspects of later videos. The video can be found hosted on the website “Youtube” at <https://www.youtube.com/watch?v=qbE2ch-9ZFc>

The second video is from “Mr. Bean” Season 1, Episode 1, Act 1, Titled “The Exam.” It features predominantly background writing with only a few short and predictable points of foreground writing. Instances of foreground writing can be found at 1:01-1:07 and again at 1:45-2:01. It takes place in a room filled with people participating in an exam giving a visual overload of the targeted stimulus. The scene fades to black at 3:01 providing a perfect stopping point. That brings it into line with other, shorter videos. “The Exam can be found hosted on the website “Youtube” at <https://www.youtube.com/watch?v=9LhLjpsstPY>

The third video is from “Marvel’s Agents of S.H.I.E.L.D” Season 5, Episode 5, Titled “Rewind.” (Minute mark 20:50-24:04) It features predominantly foreground drawing. In it, a child is drawing on paper in a park as people ask her questions attempting to get her to talk. The video consists of several swirling, over-exaggerated wrist movements more closely associated with drawing than writing. The video is not currently available to the public but is accessed at Amazon https://www.amazon.com/gp/video/detail/B077SDXY8T/ref=atv_yvl_list_pr_1

The fourth Video is from “Harry Potter and the Chamber of Secrets” and features foreground writing. In it, a child writes with a quill in a journal making large exaggerated strokes. The scene is the shortest one featured, clocking in at only 1:42. The scene can be accessed on the website “Youtube” at https://www.youtube.com/watch?v=dZewnFXl_MY

Appendix E

Debrief Letter

Thank you for participating in our study. In this study, I did use deception; I was not interested in generic responsiveness but rather the degree to which an individual would unknowingly imitate witnessed behavior. The questionnaire was used specifically to determine if participants spent a significant amount of leisure time engaging in activities that foster imitative reactivity. The pencil test was conducted to determine people's level of emulative responsiveness to actions models took in the video. I hypothesize that participants that watch characters on a screen perform actions such as writing or drawing will automatically imitate these observed movements while holding a pen to paper.

Please note that I am not interested in your individual results; rather, I am only interested in the results of a large group of participants, of which you are now a part of. No identifying information about you will be associated with any of the findings.

If you have any questions or concerns regarding any portion of this study, please do not hesitate to bring them up now or in the future. Our contact information is found at the bottom of this letter. If you are interested in obtaining a summary of the findings of this study later, please contact me and I will make it available to you at the completion of this project.

Thank you again for your valuable contribution to this study.

Sincerely,

Principal Investigator:

G. Adam Martz

314-566-5774 (gam754@lindenwood.edu)

Supervisor:

Dr. Michiko Nohara-LeClair

636-949-4371 (mnohara-leclair@lindenwood.edu)

Appendix F

Recruitment Statement

How do we react to watching television and movies? What are we learning from consumption of entertainment media in the age of binge-watching? I am inviting all LPP users to participate in a study measuring general reactivity to visual stimuli to help answer these questions! This study involves watching television while having reactions recorded. No defining features will be captured during this study.