White Paper: Using Neuroscience in the U.S. and Cairo to Enhance Persuasion and Social Influence For: ONR BAA-12-016 From: Matthew Lieberman, UCLA Date: September 30, 2012

In the wake of 9/11 and more recent developments throughout Northern Africa, it is imperative that we develop empirically-based procedures for countering messages that promote violent extremism and anti-Western beliefs, and spread messages supporting the acceptance of religious and political tolerance. Despite this need, there has been a chasm between the empirical study of social influence in the laboratory and how it might function more broadly in the world, particularly within predominantly Muslim nations in the Middle East and North Africa. Do the same strategies and tactics that work with White Americans similarly affect Muslim individuals? Do we have a way to develop persuasive messaging here in the U.S. and have confidence that it will be effective half a world away? Can natural resistance to U.S. counter messaging be overcome through empirically guided interventions? In the current proposal we take behavioral and neuroscientific approaches to addressing these issues. In addition to proposing neuroimaging studies of social influence in the U.S., given advances in portable neuroimaging technology, we will also validate U.S. findings with Muslim individuals living in Cairo.

## Research on social influence and persuasion

There is an extensive literature on the variables that can be manipulated within persuasive messages to make them more influential (Petty & Wegener, 1998). Source variables include credibility, expertise, trustworthiness, attractiveness, likeability, and power. Message variables include issue importance, position, conclusion drawing, use of rhetorical questions, argument quality, argument quantity, positive vs. negative framing, use of fear or threat appeals, emotional vs. reason-based content. Each of these factors can interact with the cognitive and motivational state of the message recipient to create a complex set of predictions regarding what types of messages and sources will be most effective under different circumstances. Unfortunately, there are a number of limitations that make this model less applicable to influencing beliefs in Muslim countries. The current proposal outlines ways in which we will address these issues to be better able to construct successful messages and promote social influence in such places.

### Neural bases of successful persuasive messages and norm-based influence

The primary goal of theories of persuasion and social influence is to be able to predict when messages will promote changes in behavior (i.e. someone convinced not to pursue violent extremism will not harm Westerners or spend time recruiting others to do this). The problem is that the best existing models only predict a very small percentage of the variance in behavior change that follows from persuasive messaging. Even when individuals are explicitly asked how the messages they have seen will change their behavior, only about 25% of the variance in message relevant behavior can be predicted (Webb & Sheeran, 2006).

The teams involved in this proposal have undertaken a research program over the last five years to use neuroscience to be better able to predict which persuasive messages will be more effective than others. In a series of studies (Falk et al., 2010, 2011), we have discovered that a region of medial prefrontal cortex (MPFC) in Brodmann area 10 (see Figure) responds to persuasive messages in a fashion far more predictive of behavior change than self-reported intentions to change behavior. We have also found (Falk, Berkman, & Lieberman, 2012), that activity in this same region in an fMRI sample predicts which advertising campaigns will be more successful



among statewide populations of viewers, far better than self-reported predictions from the same sample.

Multiple studies from other labs (Berns et al., 2010; Campbell-Meiklejohn et al. 2010) have also identified this MPFC region during norm-based influence (e.g. liking an face more after being informed that others had rated this face favorably). Although we have not yet published on the neural bases of norm-based influence, the UCLA and University of Michigan labs are each currently analyzing fMRI data they have been collected in this domain.

# **Overcoming resistance**

Persuasive message research rarely focuses on topics for which message recipients are predisposed to resist the messaging. As a result, relatively little is known about persuasion techniques that overcome such resistance. Given that those who have already begun to adopt the rhetoric of violent extremism may be highly resistant to counter messaging, strategies that can overcome counter messaging are essential. To date, no neuroimaging studies have examined resistance to persuasion or the neural signature of overcoming resistance. Behavioral research over just the last decade has generated three potential mechanisms for overcoming resistance that will be tested in the currently proposed research.

*Affirmation*. This approach assumes that resistance occurs in part because altering identity-related beliefs is threatening. In a number of studies, when another aspect of one's identity is reflected on and affirmed, individuals have been more open to counter-attitudinal messaging, particular in the domain of threatening health messaging (Jacks & O'Brien, 2004). Thus, the first strategy we will employ for overcoming resistance is to affirm an important aspect of the self prior to exposure to persuasive messages.

*Resource depletion.* The next strategy posits that resisting persuasive messaging is an effortful process that consumes self-control resources. Depleting self-control resources is known to impair the ability for self-control for several minutes following the depleting act (Muraven et al., 1998). Multiple studies have observed that under conditions of resource depletion, there is less resistance to persuasion (Burkley, 2008; Wheeler et al., 2007). Thus, the second strategy we will employ for overcoming resistance is to have individuals engage in a resource depleting task prior to exposure to persuasive messages.

*Narrative persuasion*. The third strategy builds on an idea related to the second, that controlled processes resources are needed to intentionally resist unwanted messaging. Additionally, individuals need to know they are the target of a persuasive message in order to generate defensive cognitions to counter the messages. Reseachers have pointed out that while past research has focused on rhetorical persuasion (i.e. argument-based messages) that clearly signal that a persuasion attempt is occurring, targets may not realize that *narrative persuasion* is a persuasion attempt. Narrative persuasion (Dal Cin et al., 2004) is indirect, relying on storytelling that encourages a target to identify with a protagonist who has experiences that are relevant to the key beliefs and encourages the target to have the same responses as the protagonist. In addition to hiding the true intent of the story, narrative persuasion may also be sufficiently absorbing to diminish the motivation to resist the messaging (Green & Block, 2000). Thus, the third strategy for overcoming resistance is to substitute narrative persuasion for the more typical rhetorical persuasion.

# Social influence in Muslim nations

Almost all of the studies of persuasion-based messaging and norm-based influence have been conducted in Western countries (e.g. U.S. and Europe). When cross-cultural comparisons are made, they are almost uniformly between Western and Eastern countries (e.g. China, Japan) thought to differ primarily in terms of independence and interdependence. No published experimental work has focused on Muslim reactions to persuasion attempts, particularly in the Middle East or North Africa where violent extremism aimed at Western countries often takes root. The currently proposed research will progress from studies of White and Muslim Americans to studies of Muslims living in Cairo, Egypt.

## Innovation

This research is innovative on multiple accounts. First the neuroscience of persuasion and social influence are new areas of study relative to most areas of cognitive and social neuroscience – an area we have helped pioneer. Additionally, these neuroscience studies will be some of the first to examine whether persuasion processes and techniques for overcoming resistance not only function similarly in Muslim Americans as they do in White Americans, but it will test these procedures in Muslims living in Cairo. We will achieve this by using functional near infrared spectroscopy (fNIRS) as a complement to traditional fMRI methods. fNIRS uses infrared light in order to detect levels of oxygenated and deoxygenated hemoglobin similar to the BOLD signal in fMRI. fNIRS works best over portions of the skull without hair. The forehead area in front of MPFC, where persuasion and social influence effects typically occur, is an ideal spot for fNIRS to detect signal. fNIRS equipment is affordable and portable. It can be shipped anywhere in the world in a box and minimal training is needed to be able to collect fNIRS data. Defense Group Inc. does work throughout the Middle East and North Africa and has partners in Cairo who will be able to assist us in setting up an fNIRS laboratory and recruiting local residents to participate in the research.

## **Planned Research**

There are three components of our proposed research focusing on persuasive messaging, norms-based influence, and social media effects respectively.

1. Persuasive messaging-based influence (UCLA & Cairo). We take as a starting point our past research promoting low resistance beliefs (i.e. using sunscreen) and its link to MPFC. Study 1 will expand our past research by using both fMRI (N=60) and fNIRS (N=60), to ensure that fNIRS can detect the predictive MPFC signal during persuasion for low resistance topics (e.g. sunscreen). Both White and Muslim American participants will be included. Study 2 will move to topics likely to encounter resistance (anti-smoking messages for participants who smoke and are not trying to quit and air pollution messages). These topics were chosen because they represent common public health issues in U.S. and Cairo and thus can be used at both sites for comparison purposes. Three manipulations for overcoming resistence (affirmation, resource depletion, narrative persuasion) will be compared between subjects with a control condition. Both White and Muslim American participants will be included. Both fMRI (N=200) and fNIRS (N=200) will be used in study 2. The sample size is derived from a basis of 25 per cell in a 2 culture by 4 condition paradigm. Study 3 will be conducted in Cairo, using fNIRS (N=100) to test the same high resistance topics in Muslim Egyptians allowing us to determine the extent to which fMRI and fNIRS persuasion findings in White and Muslim Americans are predictive of responses in Muslim Egyptians. It should be noted that studies 2 and 3 will include the topic of religious tolerance in addition to public health topics. Although religious tolerance in currently diminished in North African Muslim groups, Islam has a long history of religious tolerance and thus this topic is ripe for study as a resistant topic where overcoming resistance is plausible.

2. Norms-based influence (U. Michigan & Cairo). This component of the research will use a variant of normative influence task previously used by Dr. Falk. Participants will judge the attractiveness of a shape after seeing (or not seeing) the average ratings of the shape from a prior group of participants. Study 4 will use fMRI (N=60) and fNIRS (N=60) to examine the neural correlates of normative influence in White and Muslim Americans. Study 5 will be conducted in Cairo, using fNIRS (N=50) to test the same normative influence task. This study will allow us to determine the extent to which fMRI and fNIRS normative influence findings in White and Muslim Americans are predictive of responses in Muslim Egyptians.

3. Neural predictors of Twitter impact in Cairo (UCLA & Egypt). Our prior work (Falk et al., 2012), indicates that neural responses of a small group can predict which persuasive messages will be more successful in mass media campaigns. In other work (Falk et al., under review; Vezich et al., in prep), we have identified a network associated with viewing messages that are destined to spread widely. Studies 6 and 7 will apply these methods with respect to social media in Egypt. Specifically, study 6 will involve Defense Group Inc. selecting a range of active Twitter topics over a one week period that are all new topics that week. We will then use fMRI (N=40) and fNIRS (N=40) to expose several Twitter messages on each topic to Muslim Americans. Defense Group Inc. already tracks Twitter trends specific to Egypt and will identify which of the selected Twitter topics went on to be highly influential over the next month and which did not. We will then be able to determine whether the fMRI and fNIRS responses to the original Twitter messages can predict which messages will spread most effectively. Study 7 will use fMRI (N=40) and fNIRS (N=40) in Muslim Americans to choose variants of public health messages that ought to spread most and least effectively in Egypt. These messages will then be introduced into Twitter in Egypt and the impact of each message will be tracked. This study will allow us to determine whether neuroscience screening of messages in the U.S. can be used to select messages that will be particularly effective when introduced into social media in other parts of the world.

## Timeline, Cost, Deliverables, & Data Management

The timeline for the studies, divided up by the primary site where the data will be collected for each study, is presented below. It is presented here as a 5 year timeline, however in the full proposal it will be broken up into a base period (years 1-3) and an option period (years 4-5). They total encumbered costs (including direct and indirect costs) is estimated at 750K per year split primarily between staffing, imaging costs, and University indirect costs.



During the proposed period, we will provide monthly status reports to the sponsor. We will also provide yearly reports focused on the concluding summary of that year's study. At the termination of the project we will provide a final briefing and final report summarizing the findings and their importance.

Dr. Lieberman (PI) will be responsible for the overall technical and financial direction and management of the project. Dr. Lieberman will identify, track and manage project progress, and disseminate project information to all personnel. Dr. Falk (Co-PI) will oversee studies 4 and 5. Finally, Dr. Gabbard will oversee DGI's contributions on studies 3, 5, 6, 7.