The Influence of Mirth and Elevation on Local and Global Information Processing

By

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Abstract

There is a vast amount of research outlining the contrasting influences of positive and negative affects but less is known about potential divergent affects of different positive affects. In this study, we ask questions about how two different positive affects, mirth and elevation, influence and shape different processing styles. Positive affects are believed to encourage global processing, but recent research shows that this influence can be malleable and vary with task. Also, previous findings show that if a participant encounters interference, a global processing strategy will result if a participant is inclined to stay engaged in this task. We hypothesize that under mirth, participants will be high in volatility (volatility is defined as the number of changing interests a participant may experience), leading them to adopt a local processing strategy when encountering a Stroop interference, and participants under elevation would adopt a global processing strategy. We use a letter task, similar to Navon (1977) and measure reaction times (RT) and accuracy. There are four conditions, mirth, elevation, sadness, or neutral, and participants are randomly placed in one condition. One significant result found is the reaction times were faster and accuracy rates were higher in the congruent trials than incongruent, confirming the Stroop Interference. Also, under mirth, participants performed the fastest in the 'hardest' condition, an incongruent trial in a local block, while participants under elevation performed equally as well in the local and global condition across both types of trials. These results suggest that mirth and elevation, which are positive affects, may exert widely different influences on information processing.

Key Words: Information processing, global processing, local processing, Stroop, interference effects, mirth, elevation, reaction time, accuracy, neutral, sadness

The Influence of Mirth and Elevation on Local and Global Information Processing

A mood often dominates a person, directing them to act a certain way, pay attention to some details and not others, and directing their feelings, essentially controlling a person. Moods seem to influence thinking and thought processes. The influence of mood on cognition has been researched for quite some time yet there is much to still be uncovered. In this study we ask whether positive moods, specifically mirth and elevation, and negative moods, influence people to process information in local or global manners. By using Stroop Interference, we can study what strategies are used to lead to a global or local way of processing information. The remainder of this paper is organized as follows: literature review on congruence effects, global vs. local processing, the influence of moods on local and global processing, interference effects, our current study, methods, results, discussion, and conclusion.

Literature Review

Congruence Effects

A mood congruence effect arises when a person's affect matches their affective actions and thinking. For example, Halbertstadt, Neidenthal, and Kushner (1995) hypothesized that happy moods would encourage people to recall happier words, and sad moods would encourage people to recall sadder words. Participants were induced into either the happy or sad condition, and then read a list of homophones, such as dear/deer or sweet/suite. It was found that participants in the sad condition recalled the sadder meanings of words more often than happy ones. The same result was not found with the happy condition though. Olafson and Ferrero (2001) hypothesized that the same effect should be found under positive affects. They created their lexical decision making study with the added component of finding out if mood congruency could increase the rate of information processing. The results showed that, indeed, the effects

found by Halberstadt et al., (1995), could be extended to positive affects. Participants under both conditions were faster at identifying mood congruent words (Olafson & Ferrero, 2001). These studies have not only shown that mood plays an integral part in cognition, but does so across multiple areas of cognition such as memory and language processing.

Global vs. Local Processing

In our study, we delve deeper into how moods can affect information processing by analyzing how global and local processing can be influenced. The best way to think about global vs. local is through a forest vs. trees view. A person can either pay attention to the forest, the global view, or the trees, the local view. Navon (1977) designed stimuli that would allow for global and local features to be shown simultaneously, similar to the ones seen in figure 1; stimuli were large Hs and Ss made up of smaller Hs and Ss. Navon predicted a global precedence to exist, meaning people should have an easier time processing global information. Navon claimed a multi-pass system to exist; the purpose of the first pass is for spatial perception, and essentially only to gain information about global features. This also allows one to gauge what to pay attention to; this information facilitates what local features should be paid attention to. The second pass allows for more careful processing of the local details to fully understand the stimulus to complete the task. To support his hypothesis, Navon conducted multiple experiments with slight differences. These differences included using an auditory interference, directing the participant's attention to local or global features, and altering the time the stimuli is viewed. In this study, there were two conditions, a global directed and a local directed, in which participants had to report on either the global or local feature of the letter. Participants were shown the letter stimuli created by Navon for a limited amount of time 40 milliseconds (ms), and then asked to

indicate which letter they saw. Participants recalled letters in the global directed condition much faster than in the local directed condition. Navon's global precedence hypothesis was supported.

Many researchers soon questioned Navon's Global Precedence hypothesis. Specific properties of the stimuli, such as the size of local vs. global features, spatial features, and types of stimuli used, might determine if a participant uses local or global information processing (Poirel, Pineau, & Mellet, 2008). Luna, Merino, and Marcos-Ruiz (1990) conducted a study examining how the global precedence effect could be diminished if the stimuli were viewed for an unlimited amount of time or if the stimuli were shapes instead of letters. Both parts of this study directed the participant to pay attention to the global or local features, like Navon (1977). Stimuli made from squares, triangles, and circles were presented to participants congruently and incongruently. The stimuli were presented to the participant for an unlimited amounted of time until the participant provided an answer using a keyboard. Regardless of the amount of time the stimuli remained on the screen or the attention direction established before the trials, participants reported the global shape more often that the local, also supporting Navon's global precedence hypothesis.

Further, Poirel, Pineau, and Mellet (2008) did not direct participants to pay attention to the global or local features, used non-traditional stimuli, such as bells, fish, and umbrellas arranged in a global and local manner, and still found that global processing still dominated. Surprisingly though, one finding did indicate that when non-sense objects were the global feature and actual objects were the local feature, local information processing was quicker, suggesting that stimuli must have some relevance or actual meaning for it to be processed quickly.

Positive vs. Negative Moods in Local and Global Processing

It has been well established that negative moods cause people to adopt a bottom up and detailed processing strategy while positive moods encourage creativity, open-mindedness, and a top-down processing strategy (Gasper & Clore, 2002; Gasper, 2004; Isbell, Lair, & Rovenpor, 2013; Schwarz, 2012; Spering, Wagener, & Funke, 2005). Positive affects are also known to cause people to think abstractly, fall to stereotypes, and are more holistic processers (Gasper & Clore, 2002; Isbell, Lair, & Rovenpor, 2013). Early hypotheses about moods and information processing predicted that people in happy conditions were less effortful in the task leading to top- down processing. It was also believed the participants relied more on schemas, heuristics, and scripts that may aid in completing a task. Scripts or schemas are forms of a general knowledge structure that contains a standard sequence of events displaying typical activities that allows a participant to rely on the script when processing information specific to the task at hand (Bless et al., 1996). Negative affects are known to lead to less reliance on scripts and schemas to complete a task. Bless et al., (1996) conducted a study to show happy and sad affects influence reliance on scripts differently. Participants listened to a restaurant story and completed a task where they were shown pictures of typical items that would be found in a restaurant. Participants under the happy affect had a higher tendency to report a typical item as having been present in the restaurant setting, even if it had not been. This suggested that under happiness people rely on more global knowledge structures to process information. In a follow up study, the researchers conducted a secondary task, which was a concentration test where participants had to identify certain letters with dashes throughout the text. The secondary task was run after participants had heard the audio clips. Results indicated that happy participants, again, reported items that are typical of a restaurant setting to be present when they were not. This supports the original finding that happy participants used global knowledge structures while information

processing. Also, happy participants performed better on the secondary task than sad participants, which suggests that happy affects have the ability to more flexible in cognitive processing, whereas the sad participants had a harder time completing a different task (Bless et al., 1996).

There is an overwhelming library of research that finds that positive affects also encourage a global perspective while information processing, whereas, negative affects encourage a local perspective while processing (Clore & Palmer, 2009; Gasper & Clore, 2002; Gasper, 2004). In cognitive tasks, cues from positive moods may draw attention to global features and cues from negative moods may draw attention to local features (Gasper & Clore, 2002). Gasper and Clore built their hypothesis on the levels of focus hypothesis. This hypothesis proposes that affective feelings experienced in a task relevant situation should guide which information is processed at a global vs. local level (Gasper & Clore, 2002). Participants were induced into either a happy or sad mood, and then were presented with stimuli of large shapes made up of smaller ones. They presented a target figure, were given two options, and asked which option most resembled the target figure. If a target figure was a square made out of circles, the two options were variations of the target, such as a circle made out of squares or a square made out of triangles. One important aspect of this design to note is that it was not explicitly stated to focus on the local or global features, making it ambiguous. Under the sad condition participants were less likely to match up shapes according to the global feature than participants under the happy condition. Overall, these findings were the first to suggest that moods can influence if people process information in a global or local manner.

The Gasper and Clore (2002) study was one of the first to examine how moods and local/global features could interact with each other to guide processing, but many questions remained about the effects. Could mood aid in faster processing in either the local or global

direction? Was it possible to remove mood effects at all or re-direct them? Gasper aimed to answer some of these questions by designing an experiment that consisted of three parts, one of which was to understand how mood effects changed when participants encountered unambiguous trials. In other words, all the trials in the Gasper and Clore (2002) study had been ambiguous in that there was not necessarily one correct answer. This allowed participants to either focus on the local or global features. In an unambiguous trial there is a clear correct answer, which may cause the participant to deem their mood irrelevant, and not let it enhance either the local or global stimuli. Results in unambiguous trials indicated mood effects disappeared in an experiment done in Gasper (2004). Both sad and happy participants answered trials correctly 96% of the time. Also, when the participants were reminded the source of their moods, moods were deemed irrelevant and mood effects never appeared. Happy and sad moods did not exert influences on reaction times, however, Gasper found that when participants in the sad mood condition were sadder, they had much faster reaction times and when participants in the happy mood were happier they also had much quicker reaction times (Gasper, 2004).

The idea that positive affects only encourage global processing and negative affects encourage local, detailed, systemic processing has been prevalent for quite some time but recent research reveals that their influences may be flexible. While several areas of cognition show direct links between affects and processing styles, these links are malleable and can be changed by context and cues (Isbell, Lair, & Ravenpor, 2013). Positive affect is known to enhance creativity and open- mindedness, as seen in previous studies, and it is easier to switch thought processes. Positive affects are also thought of as a green light cuing a continuation of the processing style being used, and negative affects as a red light cuing a problem or obstacle. Could participants experiencing a positive affect have an easier time processing local

information than global if they were told to focus on the local features? In a study conducted by Huntsinger, Clore, and Bar-Anan (2010), participants were primed into a local or global style of processing by either completing a lexical decision task, which included processing style words like global, local, distinct, etc., or through a variation of the Navon (1977) letters task. In the priming task, participants are told to report on either the global letter or the local letter only. After the priming task and mood induction, participants again encountered a variation of Navon's letters task. For participants primed to the global condition, earlier results were replicated, showing that participants under positive affects reported more global features. However, participants primed in the local condition displayed opposite effects; participants under positive affect reported more local features, and participants under a negative affect reported more global features.

Positive affects may actually increase the dominant response and negative affects may decrease frequency of the dominant response (Clore & Palmer, 2009). The cognitive malleability approach, as it is known, states that moods may not necessarily dictate processing but rather guide it by providing feedback of the appropriateness of the processing style being used. Thus far, research in multiple areas of cognition, such as perception and attention, have shown us that depending on if a global or local processing style is primed, people will process in that particular style until their mood cues them to switch to a different one (Isbell et. al., 2013).

It is no surprise that many previous studies have found that positive affect encourages global processing and negative affect encourages local processing because in majority of the studies not a specific processing style has been primed. Since from the global precedence hypothesis we know that people have a natural tendency to process information globally, this may be the processing style that occurs when local or global condition has not been primed.

Priming not only shows cognitive flexibility to adopt different styles, but it also sheds light on how moods encourage cognitive flexibility.

Interference Effects

Stroop like stimuli or stimuli that is "composed of two or more dimensions that convey congruent or conflicting information (Christman, 2001)," is an effective tool used to study information processing. The classic Stroop Effect, developed by Stanley Stroop, is the delayed reaction time that occurs when people must identify names of colors in the color not denoted by the name. For example, if the word is blue but the color of the word is red, participants are asked to name the word, and there is a delay in reaction time because participants are reading blue but seeing red. Since the brain is receiving conflicting information about colors, it shows as a delay in reaction time.

In a study completed by Marguc, Forster, and Van Kleef (2011), they hypothesized that when people faced an obstacle (in this study, an obstacle was defined as an interfering force), if the task is too difficult, participants will disengage from the task. However, disengagement from the task is also moderated by the individual's level of volatility, as described as part of Kuhl's theory of action control (Kuhl, 1994; as cited in Marguc et al,. 2011). Volatility is defined as the number of changing interests a participant may have in the task. An individual low in volatility may be immersed and highly engaged in their activity. These individuals are more inclined to follow through and complete the task they are doing. When an individual is low in volatility, when facing interference, they will be more likely to adopt a global processing style to better understand the whole situation, work around the interfering force, or find an alternative solution to complete the task. An individual under high volatility may have the ability to multitask or have multiple goals and interests that seem desirable. These kinds of individuals are less inclined

to complete ongoing activities even if they are doing well. High volatility individuals should not adopt a global processing style.

In one particular study, participants heard background noise as the interference, completed an anagram task simultaneously, and then completed a secondary task. Researchers hypothesized that participants who encountered the interfering force should take longer to complete the anagram task, but would also demonstrate a global perspective during information processing in subsequent tasks. A variation of the Navon (1977) letters task (global letters were Hs and Fs and local letters were Ls and Ts) was completed after the anagram task. Participants' attentions were not directed to local or global features, therefore all the trials were ambiguous. Results indicated that participants who had encountered the obstacle indicated global letters faster than local letters, suggesting a global focus.

In another study completed by Marguc, Forster, and Van Kleef (2011), participants completed a questionnaire to measure their level of volatility. An example of a question on the questionnaire is "When I'm working on something that is important to me, I… a) I like to work on other things at the same time or b) I get so focused, I work on it for a long time." Participants then completed an anagram task while listening to background noise, similar to the previous study. After, a variation of the Navon (1977) letters task was completed except this time the letters were replaced with shapes, and instead of reporting if the participant saw the global feature or the local feature, participants were provided with 2 options that looked similar to the target figure. They were asked to indicate which one resembled the target figure most closely. Participants who had scored low on the volatility questionnaire were classified as having low volatility. In the obstacle condition, these participants made more global choices than those who

scored high on the volatility questionnaire, supporting the researchers hypothesis that low volatility will lead to global information processing.

On the other hand, studies have aimed to test the limits of the global interference. Amirkhiabani and Lovegrove (1999) demonstrated that although a global advantage exists regardless of the eccentricity or spatial position of the stimuli, the level of interference is highly dependent upon these two things. For example, when a stimulus is small and centrally located, the local elements are actually detected more quickly if it is congruent but if the image is moved to the side, RT becomes much slower. The opposite is also true; a faster RT in the global condition does not necessarily mean the interference effects from the local condition do not have much of an influence, but that the placement of the stimuli could potentially interfere with the interference effect. There is much to be learned still about the variability of the global and local interference effects.

Current Study

The aim of our study was to investigate whether two different positive affects, mirth and elevation, could guide information processing in a local or global manner. There is a prolific amount of research outlining the various effects of positive and negative moods, but there is a range of positive moods from happy to joy to proud, and a range of negative moods from angry to sad to disappointed. Affects other than happy and sad are rarely studied but they are labeled as positive and negative affect, respectively, giving the impression that all positive and negative affects produce the same effects. There is more literature on the effects of various negative affects than positive currently, and this may be because various negative affects, such as angry and sad, are more clearly defined, and easier to induce than positive affects. However, recent studies have investigated positive affects other than just happy. In a study on moral judgment,

Strohminger, Lewis, & Meyer (2011) found that elevation and mirth, which are considered to be positive affects, influenced moral judgments differently.

Our study is different from previous studies in the following ways: 1) elevation and mirth have never really been researched in information processing, 2) we use 5 consonants and 5 vowels to create the interference in our stimuli, 3) we direct participant's attention to report on the local or global feature in every block. All of our trials are unambiguous; there is a very clear correct answer for every trial. 4) Our mood induction schedule is also different. Participants experience a mood induction (listening to an audio clip) every three blocks in blocks 10-18 of the experiment. This allows us to maximize the effect of mood.

Elevation is a feeling that "arises from witnessing acts of moral beauty, and establishes a mindset whereby people want to act in a more noble, saint like way (Strohminger et al., 2011)." They may also want to be helpful or do 'good.' Mirth is a positive affect associated with humor (Strohminger et al., 2011). We also included a neutral condition as a baseline as well as a sadness condition to compare the positive affects to.

The hypotheses that come out of the literature are that positive affects should encourage a global focus while processing information. Participants in both mirth and elevation should show better performance (faster RTs and higher accuracy) in the global condition. Participants under sadness should fare better in the local condition. Participants in the neutral condition should display a global focus while processing information, since global processing is believed to be the natural predisposition (Navon, 1977; Poirel, Pineau, & Mellet, 2008).

On the other hand, recent literature has suggested that these observations may not be as accurate, and the effects of mood on local/global information processing may actually be more flexible. Although, influences of elevation and mirth have not been specifically studied, we will

suggest some hypotheses. Elevation is an affect that causes people to feel like doing 'good,' and feel helpful, meaning they may feel more inclined to stay engaged in the task and put forth their best effort. Recall the findings from the Marguc, Forster, and Van Kleef (2011) that an individual with low volatility will display a global processing style. We predict elevation will activate low volatility in a participant. We predict this to occur because after hearing clips of people giving back to their community, doing 'good', and hearing inspiring stories, participants will also feel a sense of duty to the task; to complete the task honestly and with full effort. As a reminder, low volatility means the participant feels a greater inclination to remain engaged in the task and complete it. This will then lead participants under elevation to display a global processing style, meaning their reaction times will be faster and accuracies higher in the global condition.

A central characteristic of mirth is that it is an affect to be taken lightly and with some degree of carelessness. After all, humor and comedy are light-hearted. Therefore, we suggest that mirth may actually activate a high volatility. Mirth may also activate a high volatility because participants may not be that interested in the task after listening to standup comedians. Their attention may redirected as a result of the light break they just received from doing the task. High volatility individuals feel less inclined to complete the task, and once they have encountered the interference, they may feel even less inclined to follow through. According to Marguc, Forster, and Van Kleef (2011), high volatility leads the participant to not adopt a global perspective while processing, but in this study, we suggest that if participants do not use a global processing strategy, then they will adopt a local processing strategy, leading them to perform better overall under the local condition, meaning faster RTs and higher accuracies in the local condition.

Under sadness, we predict that participants will adopt a local or global processing strategy depending on if attention is directed to global features or local features, respectively. Recall, the result from Hunstsinger, Clore, and Bar-Anan (2010), where participants primed in the local condition, under sadness, actually reported more global features, and participants primed in the global condition reported more local features in the task. As a result of this switch, RTs and accuracies should be similar in both the local and global condition. In the neutral mood condition, we expect to replicate previous findings in that there will be a global processing dominance, meaning quicker RTs and high accuracies in the global condition than the local condition. Table 2 outlines the various predictions for each mood type and the kinds of predictions that come out of the literature, as well as the predictions that have been suggested based on more recent findings. In the different trial types (incongruent and congruent), we expect to find that congruent trials are the easier to complete, so we expect to find lower RTs and higher accuracies than in the incongruent condition. The incongruent trials should have the slowest RTs across all conditions as a result of the Stroop Interference.

Methods

Participants

Seventy-eight participants between the ages of 18- 28 years old (Females = 50 Males = 23, the genders of five participants were not recorded) participated in the study. The first five subjects were discarded because of changes made to the study after their participation. Four more subjects were discarded for reasons of missing data or technical difficulties with the experiment. Participants were mainly University of Michigan students or part of the Ann Arbor community.

Prior to the study, participants filled out a consent form that outlined the study requirements, which included that all participants must have normal to corrected vision (contacts

only), no history of psychological or neurological issues, and must be right handed. A brief description of the study, risks, and benefits were also included on the form. After completion of the study, participants were compensated $10/hr. If for some reason, participants were not able to complete the study or we had to terminate, they were given $5 for their participation.

Design

In this study there are three main factors: mood, block condition, and congruency. Mood is a between subjects factor, with a participant being randomly placed into one of four moods. The four mood conditions are neutral, sadness, mirth, and elevation. There are two block conditions, global or local. This is a within- subjects factor. Congruency refers to the type of trial a participant encounters. There are two types, a congruent trial or incongruent trial. What entails a congruent or incongruent trial is explained further in the stimuli section. This is also a within-subject factor.

There are a total of 18 blocks with ten trials each, plus a practice block. Each block is characterized to be a global block or local block. This means that for each block, the participant is told to report only on the global feature or only on the local feature.

In the first half of the study (blocks 1-9), no mood induction occurs. The first mood induction using an audio clip occurs right after the 9^{th} block but before the 10^{th} block begins. A mood induction occurs every three blocks (before block 10, block 13, and block 16).

One important aspect about our study is that we do not explicitly measure an individual's volatility. We use volatility as a theoretical reasoning to suggest why participants in mirth and elevation should process information in different ways. Also, we did not take volatility measures because we are not actually trying to understand how volatility influences processing; we are

aiming to understand how mood influences processing and we have an experimental manipulation for that.

Stimuli

The task consisted of various vowels and consonants that were arranged in a large letter/small letter (global/local) arrangement (see figure 1). All the vowels (A, E, I, O, & U) and the top five used consonants (R, S, T, L, & N) were used to create the stimuli. There were a total of 100 combinations; 50 incongruent trials, 40 congruent trials, and 10 identical trials. Incongruent trials meant that there was a vowel and consonant present in the stimuli. All the vowels were the global features at least once and all the consonants were the global features at least once. All the vowels and consonants were also the local features at least once in the study. Congruent trials meant that local and global letters were vowels or consonants (e.g. A is the global letter and E is the local letter). Identical trials meant that local and global letters were the same (e.g. A is the local and global letter). This type of trial also had the least amount of interference making it the 'easiest' trial. The hardest type of trial was the one with the most interference, an incongruent trial in the local condition. Vowels and consonants were presented in capital form, in Helvetica, and in 600-point font.

Three audio clips in each mood condition were used to induce sadness, elevation, mirth, or neutral. Elevation, neutral, and mirth clips were obtained from the Strohminger, Lewis, and Meyer (2011) study. Elevation clips were shortened versions of stories from the *Chicken Soup for the Soul* series; mirth clips were recorded from the standup comedy of Jerry Seinfeld and Mitch Hederberg. The neutral clips were recordings of professors' lectures from the *Science and the City* podcasts (Strohminger et al., 2011). Sadness clips were modified from the elevation clips by removing the uplifting parts of the story and extending the sadness parts. The

experimenters recorded these. All the clips were approximately 3.5 minutes long. After listening to each clip, participants answered a nine-question survey and rated their responses on a Likert scale from 1-5, 1 being the least to 5 being the most. Table 1 shows all nine questions asked in the survey.

At the end of the study, another questionnaire was given asking what the participant thought of the study, what they found interesting, if anything should be changed, etc.

Apparatus

The experiment made use of a desk -mounted eye-tracker, SR-Research EyeLink-1000 operating at 1000Hz, but this thesis does not focus on data collected from the eye-tracker. The stimulus was presented on a 19in. Cathode Ray Tube (CRT) monitor. Headphones were used to listen to the audio clips, and a keyboard was used to collect responses and RTs. Two keys were designated to indicate either a vowel or consonant (f for vowel and j for consonant.)

Measures

There were two kinds of measures collected from each subject, reaction times (RT) and accuracy. Reaction times and accuracy were collected for each trial, which led to multiple measures for each subject. The stimulus was presented to the participant for a maximum of 500 milliseconds (ms). The reaction times are measured in milliseconds from the onset of the stimulus.

Procedure

Participants were randomly assigned to one of the four mood conditions (neutral, sad, mirth, or elevation). The task remained the same for every participant except for the mood condition. The participant sat at eye level with the monitor and placed their head on the chin rest and headrest of the desk-mounted eye-tracker. Once the eye tracker was adjusted to the most

accurate position for the participant, the participants were briefed on what would happen in the experiment and the experimenter then left the room. The experimenter and participant were in two different rooms. The experimenter controlled the study from another room, and communicated with the participant through an intercom.

The experiment was promptly started after and the directions were displayed to the participant. Figure 2 shows the progression of the entire study from the beginning to the end. A practice block of ten trials followed the directions. Before each block, a one-line direction was given to the participant directing them to report on the global or local feature of the trials. For example a direction would look like this:

"Please report if the GLOBAL letter you see is a vowel or consonant."

The direction between focusing on the global or local alternated with every block. Before beginning the trial, there is a drift correction that occurs. After the completion of every trial, there is a feedback screen indicating whether the answer was correct, the speed, and bonus points earned. The bonus points in this experiment served no purpose other than to give the subject something to work for. At the end of every block, another feedback screen indicating the total points earned and average points earned in each block is displayed. This procedure is the same throughout nine blocks. After the ninth block, a direction screen appears telling the participant to remove their head from the eye-tracker, and listen to the audio clip. Figure 2 shows exactly before which blocks the clips were played. The audio clip starts playing once the participant is ready and presses the spacebar. The mood questionnaire appears right after the clip is completed. Again, following the mood questionnaire, another block is presented to the participant. An audio clip is played every three blocks. Once the entire experiment is completed, the participant is

given a post-experiment questionnaire, verbally debriefed (as well as given a paper copy), and given their payment coupon.

Results

Out of the total 78 participants we had, 68 participants were included in the data analysis. In addition to the subjects excluded from the methods section, one subject was also disregarded for unusual data patterns, totaling ten excluded participants. Data was analyzed in two sections, the blocks before the mood inductions occurred (blocks 1-9) and the blocks in which the mood inductions occurred (10-18).

Analysis of the data was done using a mixed effects model and model comparisons using a Likelihood Ratio Test (Winter, 2013). The design of this study was complex in the sense that there were fixed effects (block-type, mood, and trial type) and random effects (subjects), hence to account for variation between subjects, a mixed effects model was chosen.

For tests of factors with two levels or omnibus tests of more than one-degree of freedom, model comparison tests were used with the associated chi squared test. For example, in one model all the factors like RT, block-type, mood, and trial type are taken into account and in another model, one of these factors is removed, such as mood. If the Likelihood Ratio Test reveals a significant difference, then we know that the factor dropped influences RT. For tests of two levels or more, a t- value, standard error, and coefficient estimate are given for each individual factor taken in the model. The specific linear mixed effects models these comparisons are made in do not compute p-values from these fits (Bates, Maechler, & Bolker, 2012; as cited in Winter, 2013). Rather t-values are given. The t-value given is the estimate divided by the standard error. A t-value above two or below negative two is considered significant. Also, we

report here effect sizes as simple differences in means in the original measurement scale because they are most meaningful for our comparisons (Cumming, 2014)."

Mood Induction

Table 1 displays the mean ratings for each question asked on the mood questionnaire. For elevation, neutral, and mirth, there were specific questions targeted to rate those moods. For example, the ratings of the variables funny, laughing, and smiling could be used to asses the level of mirth a participant was experiencing. The mean ratings of these variables under mirth was to understand if mirth really was funnier or if people smiled more under mirth that the other mood conditions. Warmth and uplifting are variables specific to elevation so we expect the mean ratings in these two variables to be higher than in the other mood conditions, and the ratings are higher in the elevation condition. The purpose of these ratings was to 'check' that each mood condition was really being experienced, as shown through the ratings, but no statistics were completed on just the moods. Rather the effects of the moods were analyzed in comparison to other factors in the experiment, such as congruency and block condition, in our model comparison tests.

Reaction times in pre-mood induction blocks

To account for skewed reaction times, all the RTs were converted to the log scale to make a more normal distribution. Also, only correct trials were included in the RT analysis. In the pre-mood induction blocks, a model including RT and trial number was compared to a model including RT, trial number, and trial type (incongruent or congruent). RTs in the congruent trial type are much faster than the incongruent trial ((χ^2 (1, N = 68) = 21.63, $p < .001$), indicating a strong Stroop interference. The differences in the RTs between the trial types are clearly seen figure 3 (local condition = 32 ms difference, global condition = 22 ms difference). However,

there is no effect of block condition (local and global) on RTs (χ^2 (1, N = 68) = 1.75, p = .19). Figure 3 also supports this result, as there is not a huge difference between the RTs in the global condition and the local. In both trial types there is a 4-6 ms difference between the local and global conditions but it is not a significant difference.

In this type of task, there is always room for adaptability as participants become more aware of what strategies work and do not work for them. As a result, they become quicker at the task as more and more blocks occur. Figure 5 shows how reaction times in congruent and incongruent trials decrease as the number of trials completed increases. In the global condition, there is an approximately 100 ms difference between the trial 10 and trial 200, in congruent and incongruent trials. In the local condition, the difference is even greater; there is an approximately 170 ms difference between trial 10 and trial 200 in the congruent trials. In the incongruent trials there is a 150 ms difference in the same range of trials. Overall, it confirms participants are adapting to the task and becoming faster regardless of the mood condition they are under.

Accuracy in pre-mood induction blocks

There is a congruency effect seen in accuracy levels, that also provides evidence of a strong Stroop interference ((χ^2 (1, N = 68) = 69.12, p < .001). Looking at figure 4, this finding is not surprising. In the local and global conditions, the incongruent trials had the lowest accuracies between the two trial-types (local = 88.0%, global = 86.9%). There are a much higher percentage of correct trials in the congruent trials than in the incongruent trials. Again, there is no effect of block condition on accuracy levels (z = 1.47, p = .13).

In the global condition the incongruent trials yielded the lowest accuracies (congruent = 95.0%, incongruent = 87.0%). In the local condition congruent trials were completed with 96.0%

accuracy and incongruent trials were completed with 89.0% accuracy. Overall, there is a 7.0-8.0% difference between the trial types.

Reaction Times in post-mood induction blocks

Figure 6 displays a graph similar to figure 5 but with RTs across all the trials for each mood condition. All the mood conditions start at approximately the same RT and, again as seen with the congruent and incongruent trials, there is a decrease in RTs as the experiment progresses in both the local and global condition. Also, the influence of listening to the mood clips in the immediately proceeding block (mood inductions start after the 110th trial) can be seen most prominently in the sad mood in the global condition, as there is a slight increase in RT. Again, as the experiment proceeds RTs decrease once again. In the local condition, such an increase in RT is also witnessed yet it is subtler, and decreases quickly in the following trials.

Comparing mood X block condition interaction, the effect of this interaction is shown to affect RTs ((χ^2 (3, N = 68) = 10.92, p = .012). This effect is mainly driven by mirth in the local condition (each mood in this model is compared back to the neutral condition to understand how the moods changed RTs.) Looking at figure 7, RTs under mirth in the local condition are actually faster than in the global condition by about ~30 seconds in both trial types. Mirth is .05 ± .02 (standard errors) faster than the average speed (t = -2.38). The .05 is a coefficient estimate on the log transformed RTs meaning that RTs under mirth are approximately 5.0% faster than the neutral mood condition, with a standard error of approximately 2.0%. In milliseconds this translates to a 32 ms decrease from the average (intercept), which is approximately 595 ms.

Also looking at figure 7, under sadness the RTs between local and global are fairly similar except for in the local condition, congruent trials are ~32 ms faster than in the global. There is marginal significance in this difference though, where RTs are faster by .03 ± .02

(standard errors), (t = -1.79). Again, this value is based on the log transformed RTs, essentially meaning that participants under sadness are 3.70% faster than the neutral mood condition participants with a standard error 2.0%. In milliseconds participants under sadness are approximately 22 ms faster than compared to participants in the neutral mood.

There is not a significant difference observed in RTs between the local and global condition in the other moods. Under elevation (looking at the same figure), there is ~ 9 ms difference between the global and local conditions. There is no significance in the elevation mood condition when compared to the neutral mood condition where RTs are slower by .009 ± .02 (standard errors), (t = .49), which is supported by Figure 6. There is a 9 ms increase in RT for participants under elevation, which is very minuscule and insignificant.

When comparing the RTs for task type (global or local condition) X congruence interaction (incongruent vs. congruent trials), there is a significant slowing effect on RTs in the incongruent trials when compared to congruent trials in the local condition over the global condition ((χ^2 (1, N = 68) = 5.1409, p = .02). Incongruent trials in the local condition are .05 ± < .001 (standard errors), (t = 7.07) slower than the congruent trial type RTs, meaning that approximately 36 ms more are spent on these trials than these trials in the global condition. Looking at figure 7, every mood except for elevation has slower RTs in the incongruent trials, the highest difference being 64 ms under the neutral mood in the local condition.

Accuracy in the post-mood induction blocks

Theoretically, a faster reaction time should lead to a decrease in the level of accuracy, yet this is not observed readily in each mood condition. Figure 8 contains plots for each mood condition displaying the percentage of correct responses for the global and local condition. The congruent trials consistently have a greater number of trials with correct responses than

incongruent trials, which are expected because of less interference in these trials. Accuracy is significantly lower on incongruent trials across the experiment when compared to congruent trials ($z = -3.77$, $p < .001$). One interesting finding to note in figure 8 is the mirth graph. In the local condition, the accuracies for the congruent and incongruent trials are very close, and also in the incongruent trial type, accuracy increased by 7%.

Between the local and global conditions, similar to RTs, there is not a uniform trend seen across all moods. Under the mirth mood condition, participants fare better in the local condition during incongruent trials (95.0%) than participants under the neutral mood condition (91.67%). In the global condition, accuracy under mirth (86.30%) is less than under neutral (88.60%). In the sadness mood condition, compared to the neutral mood condition, there are differences in accuracy in both trial types in the local and global condition. Overall, under the sadness condition, participants are less accurate across all conditions than participants in the other mood conditions.

Comparing block-type X mood X trial-type interactions on accuracy, there were no significant interactions observed.

Discussion

Overall, this study was created to understand if two different positive affects, mirth and elevation, could influence if a person uses local or global information processing in different ways using an interference task. Recall our earlier predictions; following the majority of our literature review, our predictions were that positive affects, no matter what they are, should activate a global perspective while processing information. This is because positive affects are known to encourage creativity, broaden thinking, and a top-down processing strategy. However, research in another area of cognition, moral judgments, revealed that mirth and elevation had

divergent effects. Also, recent studies (Huntsinger, Clore, & Bar-Anan, 2010) have shown that the influence of positive and negative affects on information processing are flexible, and can be changed depending on the design and stimuli used in the study. Since elevation and mirth have not really been researched in information processing, we suggested some alternate hypotheses. Using the concept of volatility, we predicted that elevation would activate low volatility in participants thus leading them to be more inclined to complete the task honestly. This should lead them to use a global information processing style. The opposite is true for mirth. Mirth is predicted to activate a high volatility thus leading them to be less inclined to complete the task as a result of the multiple changing interests they may have. This should then lead to a local information processing style. For sadness, we predicted that RTs and accuracy levels should remain the same regardless of the condition because if participants are told to focus on one feature, such as the global, then they will display a local processing style. If they are told to focus on the local features, then they will display a global processing style. Essentially, they should perform just as well in both conditions. First we will discuss the results from the pre-mood induction blocks, then move to the post-mood induction blocks, discussing support or no support for our predictions as we move along.

In the pre-mood induction blocks, there was a strong Stroop effect found in RTs; incongruent trials took much longer to complete than congruent trials. However, previous findings about the global advantage were not supported. The RTs in both the congruent and incongruent trials in the global and local block conditions were similar, as seen in figure 3. While RTs are slightly faster in the global condition over the local condition, the differences between the two are not significant. These two findings support that a Stroop Interference slows down the rate of information processing.

A strong Stroop effect was also found in accuracy levels. Participants had a much higher percentage of correct congruent trials than incongruent trials. Although, similar to RTs, between the local and global block conditions, not much of an accuracy difference was observed. In this type of task a speed-accuracy tradeoff is expected, but interestingly, there is no such tradeoff observed in the pre-mood blocks. Looking at figures 3 and 4, there is no uniform trend between RTs and accuracy levels. In fact, congruent trials in the local condition are the fastest overall, yet, have the highest percentage correct trials at 96%. According to a speed-accuracy tradeoff, the less time spent on a task, an increased number of errors should occur, lowering accuracy rates. The lack of this effect may actually be because congruent and incongruent trials vary in difficulty level. Incongruent trials in the local condition are the 'hardest' type of trial because they contain the most interference but it may be so much harder than the congruent trial that the amount of time spent on the trial may not influence if a participant responds correctly to the trial. Overall, our hypothesis that incongruent trials would be harder to complete than congruent trials, indicated through slower RTs and lower accuracy levels, was supported.

In the post-mood induction blocks, there were a few questions to be answered. One question is how did mirth, elevation, and sadness compare in RTs? Mirth had overall the lowest RTs of all the mood conditions. Participants in the mirth condition had the fastest RTs in the 'hardest' condition, which was an incongruent trial in the local condition. RTs in the local condition were also faster than in the global condition under mirth. The opposite effect is seen in elevation. Under elevation, looking at figure 7, RTs in both trial types and block conditions are almost the same, but looking closely there is a very slight difference when congruent trials in the global condition are faster. Even if the difference is not great enough to confidently suggest that elevation activates a global perspective while information processing, there is certainly a major

difference between the effect of mirth and elevation. Under sadness, there is no difference between the global and local condition in the incongruent trials, but in the congruent trials, RTs were faster, also supporting our hypothesis that congruent trials would have faster RTs than incongruent trials. The finding that congruent trials are faster than incongruent trials in sadness and mirth suggests that mood may not affect congruence as much as the strength of the interference. The significant lowering of RTs in the local condition under mirth is one piece of evidence that supports our suggested hypothesis that mirth may activate a local perspective when processing.

How did sadness, mirth, and elevation compare in accuracy levels? Across all three moods, there was a large Stroop effect present, which is seen in figure 8. Under elevation, there was not a significant difference in accuracy between the global and local condition. In sadness and mirth, in incongruent trials, there were large differences between the global and local conditions. In mirth, accuracy increased in the local condition, while in sadness accuracy decreased in the local condition. There were no such differences in the congruent trials which is interesting because this suggests that either the Stroop Interference interacted with mood to influence a strategy to process information from the stimuli, or the processing strategy already activated by the mood allowed the participant to navigate around the interference either successfully, in the case of mirth, or less successfully, in the case of sadness. It is also interesting to note that this effect was not present in elevation. Again, the increased accuracy in the local condition under mirth support our mirth hypothesis, as well as provide more evidence to show that positive affects do not affect information processing in the same way. The difference in accuracy level in the sadness condition does not support our hypothesis for sadness, though. It is widely believed that sadness as a negative affect is supposed to encourage a local processing

style, yet according to our study we cannot support that because we do not have sufficient evidence for it, but we also do not have enough evidence to refute it. We predicted that accuracy levels should be similar but by looking at figure 8, it is clear that participants under sadness may still display a local processing style, at least when there is a slight interference.

An unexpected finding while analyzing data suggests that mood intensity may also play a role in information processing. This finding was also found in Gasper (2004), and it was also a novel finding the author did not expect to find. When participants in the sadness condition rated clips less negatively (but not positively), their reaction times were much slower than when they rated clips very negatively. When participants in the three other mood conditions, though, rated clips more negatively, their reaction times also became slower. Figure 9 shows reaction times against the ratings for each question separated by the sadness condition and the other mood conditions. This finding may indicate that when participants feel the mood intensity of the clips do not match up to the intensity of the mood they are experiencing, participants take much longer to complete the task. The more positive a participant felt, the faster they completed the task, but the more negative a participant felt also meant a decreased RT in completing the task. The more intensely someone is experiencing a mood, as determined by the rating, the quicker they are at the task. A future study should explore the question whether mood fluctuations over the experiment correlate with performance as well.

Limitations

The clips used to induce elevation, mirth, and neutral came from the Strohminger, Lewis, & Meyer (2011) study so the mood questionnaire made for those clips were made to assess elevation, mirth, and neutral moods. In our study, we also included sadness, but there were no specific questions geared towards assessing sadness. Another limitation that we encountered was

the times the subjects were run. Majority of the people that completed the study were students at the University of Michigan or neighboring schools, and we began the study after the end of finals before students left for winter break. We continued the study right after classes started for a new semester and ran through early February, near the time of midterms. The various moods that students may have already been under as a result of school, life, and stress could have interacted with our mood inductions and influenced how they completed the task.

Conclusion

Overall, one of our main and novel findings is that mirth as a positive affect activates a local processing style, as seen by the faster RTs and increased accuracy when compared to the global condition. Elevation, on the other hand, clearly does not encourage a local processing style, but there is not enough evidence to support our hypothesis that it activates a global perspective while processing, but we also cannot say our hypothesis is incorrect. More research should be conducted on the influence of elevation to really understand the kinds of effects that come from it. One of the broader goals of our study was to investigate whether two different positive affects could exert different influences, and with support from our data, we can confidently say that not all positive affects are going to guide information processing using the same strategies.

References

Amirkhiabani, G., & Lovegrove, W. J. (1999). Do the global advantage and interference effects vary? *Perception & Psychophysics*, *61*(7), 1308-1319. doi:10.3758/BF03206182

Bates, D., Maechler, M., & Bolker, B. (2013). lme4: Linear mixed-effects models using S4 classes, 2012. *R package version 0.999999-0*.

Bless, H., Clore, G.L., Schwarz, N., Golisano, V., Rabe, C., & Wölk, M. (1996). Mood and the use of scripts: Does happy mood really lead to mindlessness? *Journal of Personality and Social Psychology, 71*, 665–679. doi:10.1037/0022-3514.71.4.665

Christman, S. D. (2001). Individual differences in Stroop and local-global processing: A possible role of interhemispheric interaction. *Brain and Cognition*, *45*(1), 97-118. doi:10.1006/brcg.2000.1259

Clore, G. L., & Palmer, J. (2009). Affective guidance of intelligent agents: How emotion controls cognition. *Cognitive Systems Research*, *10*(1), 21-30. doi:10.1016/j.cogsys.2008.03.002

Cumming, G. (2014). The new statistics: Why and how. *Psychological Science*, 25 (1), 7–29. doi:10.1177/0956797613504966

Gasper, K., & Clore, G. L. (2002). Attending to the big picture: Mood and global versus local processing of visual information. *Psychological Science*, *13*(1), 34-40. doi:10.1111/1467-9280.00406

Gasper,K. (2004): Do you see what I see? Affect and visual information processing. *Cognition & Emotion, 18*(3), 405-421. doi:10.1080/02699930341000068

Halberstadt, J. B., Niedenthal, P. M., & Kushner, J. (1995). Resolution of lexical ambiguity by emotional state. *Psychological Science Cambridge*, *6 (1)*, 278-278. doi:10.1111/j.1467-9280.1995.tb00511.x

Huntsinger, J. R., Clore, G. L., & Bar-Anan, Y. (2010). Mood and global–local focus: Priming a local focus reverses the link between mood and global–local processing. *Emotion*, *10*(5), 722. doi:10.1037/a0019356

Isbell, L. M., Lair, E. C., & Rovenpor, D. R. (2013). Affect‐as‐Information about Processing Styles: A Cognitive Malleability Approach. *Social and Personality Psychology Compass*, *7*(2), 93-114. doi:10.1111/spc3.12010

Kuhl, J. (1994). A theory of action and state orientations. *Volition and Personality: Action versus State Orientation, 9*-46.

Luna, D., Merino, J. M., & Marcos-Ruiz, R. (1990). Processing dominance of global and local information in visual patterns. *Acta Psychologica*, *73*(2), 131-143. doi:10.1016/0001-6918(90)90075-Q

Marguc, J., Förster, J., & Van Kleef, G. A. (2011). Stepping back to see the big picture: When obstacles elicit global processing. *Journal of Personality And Social Psychology*, *101*(5), 883-901. doi:10.1037/a0025013

Navon, D. (1977). Forest before trees: The precedence of global features in visual perception. *Cognitive Psychology*, *9*(3), 353-383. doi:10.1016/0010-0285(77)90012-3

Olafson, K. M., & Ferraro, F. R. (2001). Effects of emotional state on lexical decision performance. *Brain and Cognition*, *45*(1), 15-20. doi:10.1006/brcg.2000.1248

Poirel, N., Pineau, A., & Mellet, E. (2008). What does the nature of the stimuli tell us about the Global Precedence Effect?. *Acta Psychologica*, *127*(1), 1-11. doi:10.1016/j.actpsy.2006.12.001

Schwarz, N. (2012). Feelings-as-information theory. In P. M. Van Lange, A. W. Kruglanski, E. Higgins (Eds.). *Handbook of Theories of Social Psychology 1(1)*, 289-308.

Spering, M., Wagener, D., & Funke, J. (2005). The role of emotions in complex problem-solving. *Cognition and Emotion*, *19*(8), 1252-1261. doi:10.1080/02699930500304886

Strohminger, N., Lewis, R. L., & Meyer, D. E. (2011). Divergent effects of different positive emotions on moral judgment. *Cognition*, *119*(2), 295-300. doi:10.1016/j.cognition.2010.12.012

Winter, B. (2013). Linear models and linear mixed effects models in R with linguistic applications. *arXiv preprint arXiv:1308.5499*.

Table 1.
Mean ratings post mood induction stimuli

Variable	Condition				Question
	Elevation	Mirth	Sadness	Neutral	
Valence	3.553	3.880	1.808	3.160	*On a scale of 1 to 5, did you experience positive or negative feelings when listening to the clip? (1 being extremely negative to 5 being extremely positive)*
Engaging	3.529	3.785	3.687	3.132	*On a scale of 1 to 5, how engaging did you find the clip? (1 being not engaging to 5 being very engaging)*
Uplifting	3.519	3.452	1.375	2.018	*On a scale from 1 to 5, how uplifting did you find this clip? (1 being not uplifting to 5 being very uplifting)*
Warmth	3.403	2.547	1.936	1.814	*On a scale from 1 to 5, how much warmth did you experience in your chest when listening to this clip? (1 being no warmth to 5 being much warmth)*
Meaning	4.211	3.476	3.037	2.083	*On a scale from 1 to 5, did you think this clip had a positive or negative meaning? (1 being extremely negative to 5 being extremely positive)*
Funny	1.019	3.547	1.648	1.041	*On a scale from 1 to 5, did you think this clip was funny? (1 being not funny to 5 being very funny)*
Laughing	1.096	2.833	1.000	1.370	*On a scale from 1 to 5, did you find yourself laughing during this clip? (1 being not laughing to 5 being laughing a lot)*
Smiling	2.010	3.523	1.187	1.754	*On a scale from 1 to 5, did you find yourself smiling during this clip? (1 being not smiling to 5 being smiling a lot)*
Interesting	3.440	3.476	3.458	3.037	*On a scale from 1 to 5, how interesting did you think this clip was? (1 being not interesting to 5 being very interesting)*

Note: The ratings for the mood scale are based on Likert Scale from 1-5.

Table 2.

Predictions

Theory	Mirth	Elevation	Sadness
From the literature- Positive affects emphasize global aspects during information processing	Participants under mirth will fare better in the blocks emphasizing global aspects. RT will be faster and there will be higher accuracies than in the local condition. The interference effect reduced in the global condition.	Participants under elevation will fare better in the blocks emphasizing global aspects. RT will be faster and there will be higher accuracies than in the local condition. The interference effect reduced in the global condition.	Participants under sadness will fare better in the local condition than the global condition. RT will be faster and accuracies will be higher than in the global condition. The interference effect reduced in the local condition.
Alternate theory- Depending upon the positive affect, the level of volatility, and the interference will cause different strategies to be used between the positive affects	Participants will fare better in the local condition because they will be more likely to have high volatility, therefore feel less inclined to complete the task with full effort. This will lead to local processing. RTs will be faster and accuracies will be higher in the local condition	Participants will fare better in the global condition because we predict elevation to activate low volatility in participants. After hearing the elevation clips, participants may feel some kind of obligation to complete the task honestly. Participants may feel more inclined to complete the task because of the effect of the mood and the low volatility.	Participants will adopt a local processing system when the global condition is primed and a global processing when the local condition is primed. Essentially, there should be no difference in the accuracy levels across both conditions and RT should also be similar with insignificant differences.

Note: The predictions from the literature would typically be expected but the alternate theory combines various findings to suggest different influence from different positive affects.

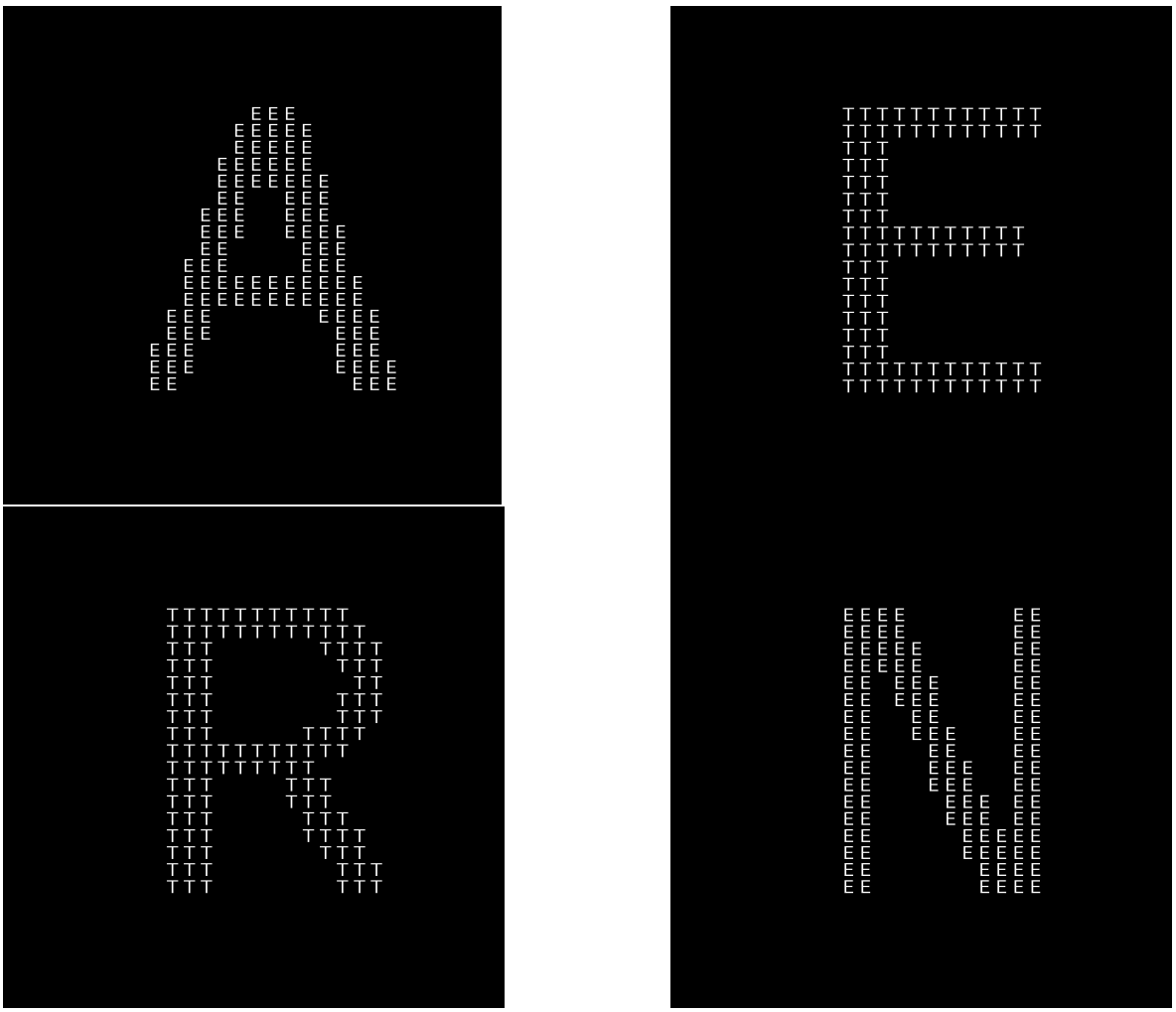

Figure 1. The picture on top left is an example of a congruent stimulus since the local and global letters are both vowels. The image in the bottom left is also an example of a congruent stimulus, but with consonants. The picture on the top right is an example of an incongruent stimulus with the vowel as the global letter and the consonant as the local letter. The picture on the bottom right is also is an example of an incongruent stimulus but with the consonant being the global letter and the vowel being the local letter.

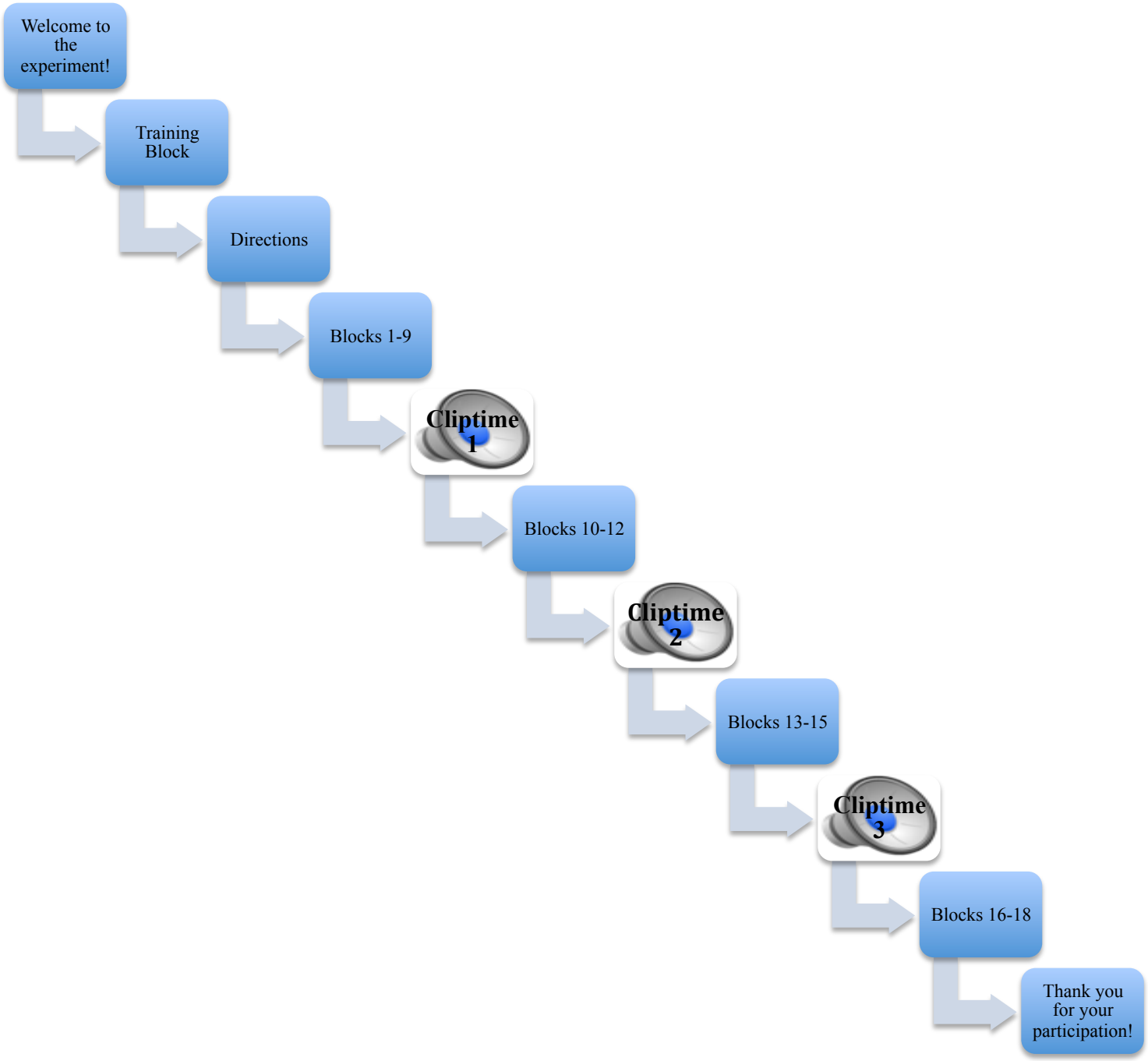

Figure 2. A visual representation of the progression of the experiment from beginning to end.

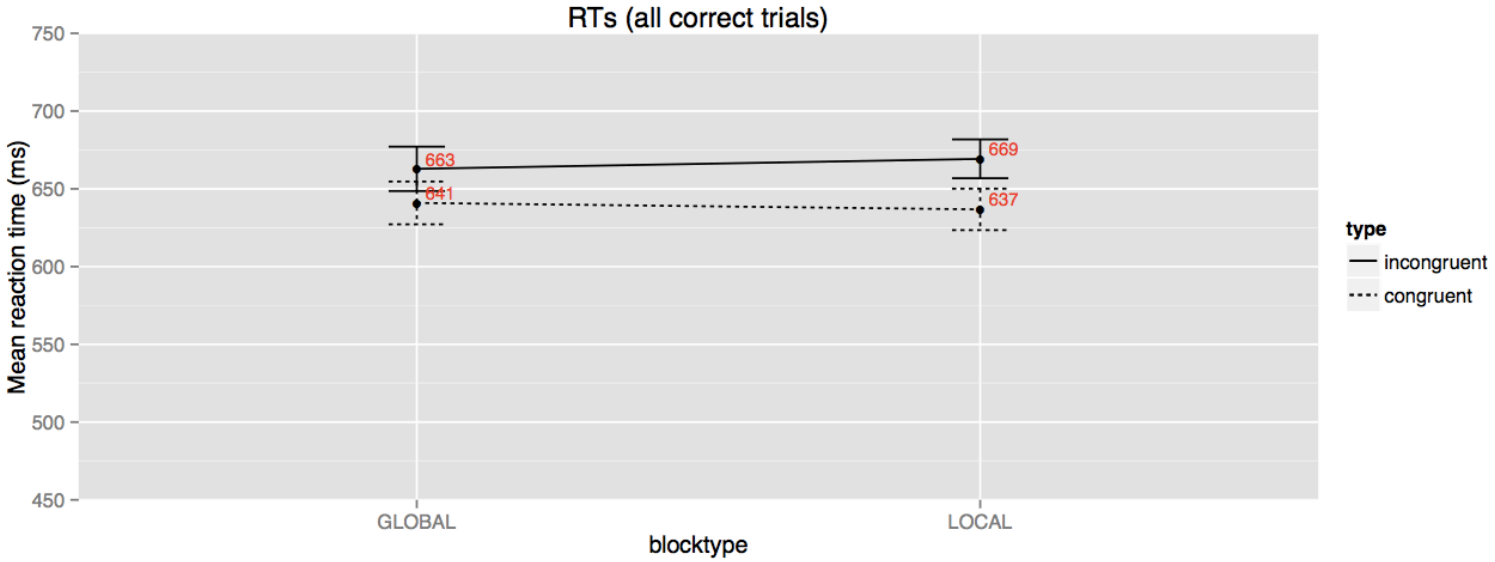

Figure 3. Mean reaction time differences between trial types (identical, congruent, and incongruent) and block-type (local or global) in the pre-mood blocks. Overall, this figure shows there is a huge RT difference between the congruent and incongruent trials, which is proof of a strong Stroop effect.

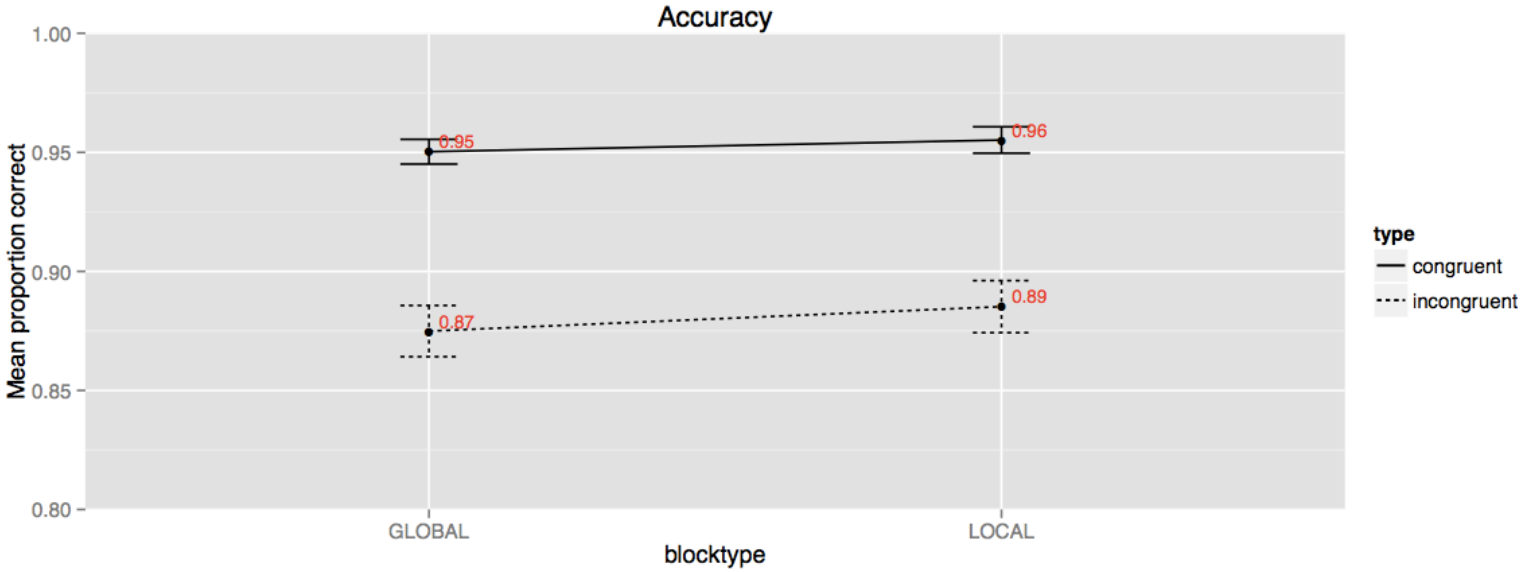

Figure 4. Proportion of correct responses between local and global conditions in congruent and incongruent trials. Incongruent trials are much harder than congruent, seen by the significantly different accuracy levels in the trial types.

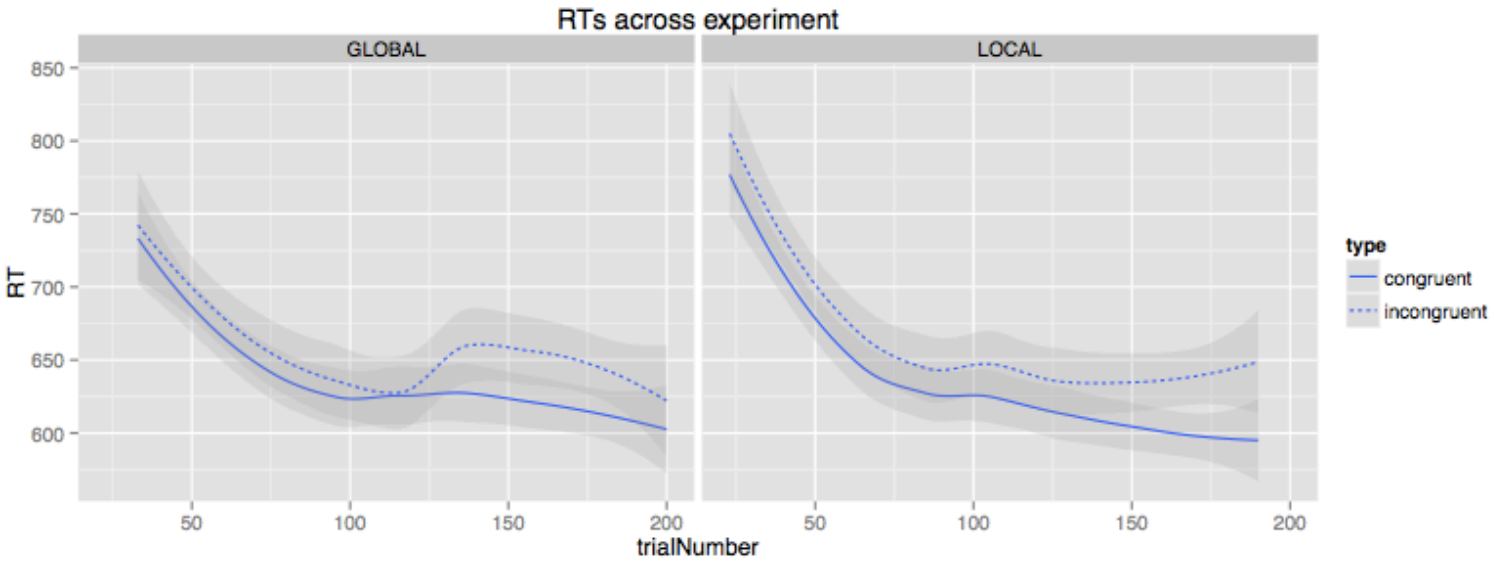

Figure 5. The mean reaction times in congruent and incongruent trials in the local and global condition. As the task progresses, participants adapt to the task and become faster regardless of the trial type.

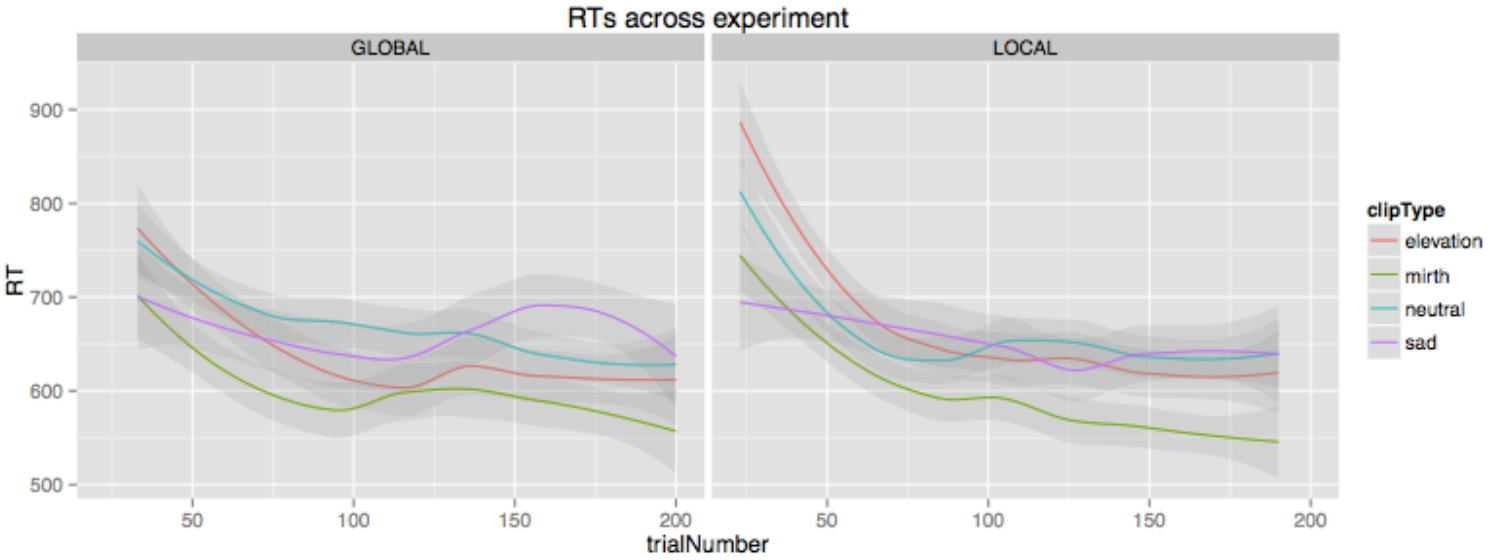

Figure 6. Reaction times across all trials for each mood condition in the local and global condition. As the task progresses, participants adapt to the task and become quicker at it, as seen by the decreasing reaction times. This is universal across all these moods.

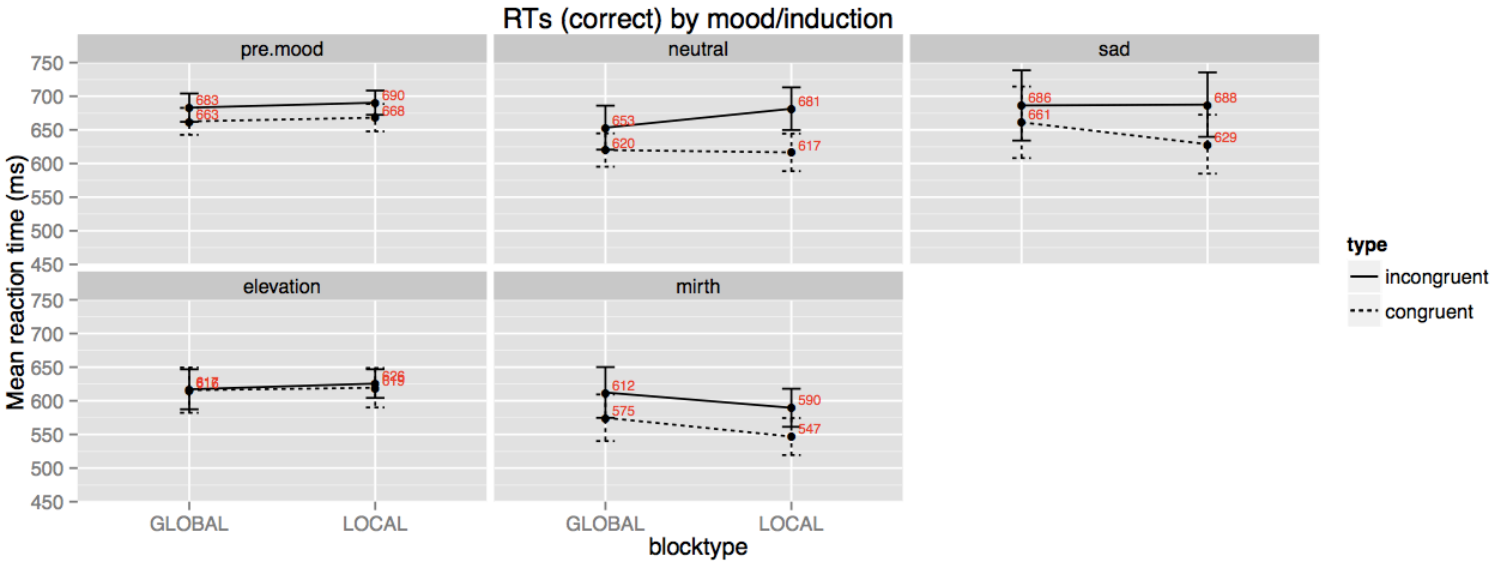

Figure 7. Mean reaction times in the global and local conditions for all trial types in each mood condition. Participants under mirth had the lowest RTs across the moods, and particularly, they were lower in the local condition over the global.

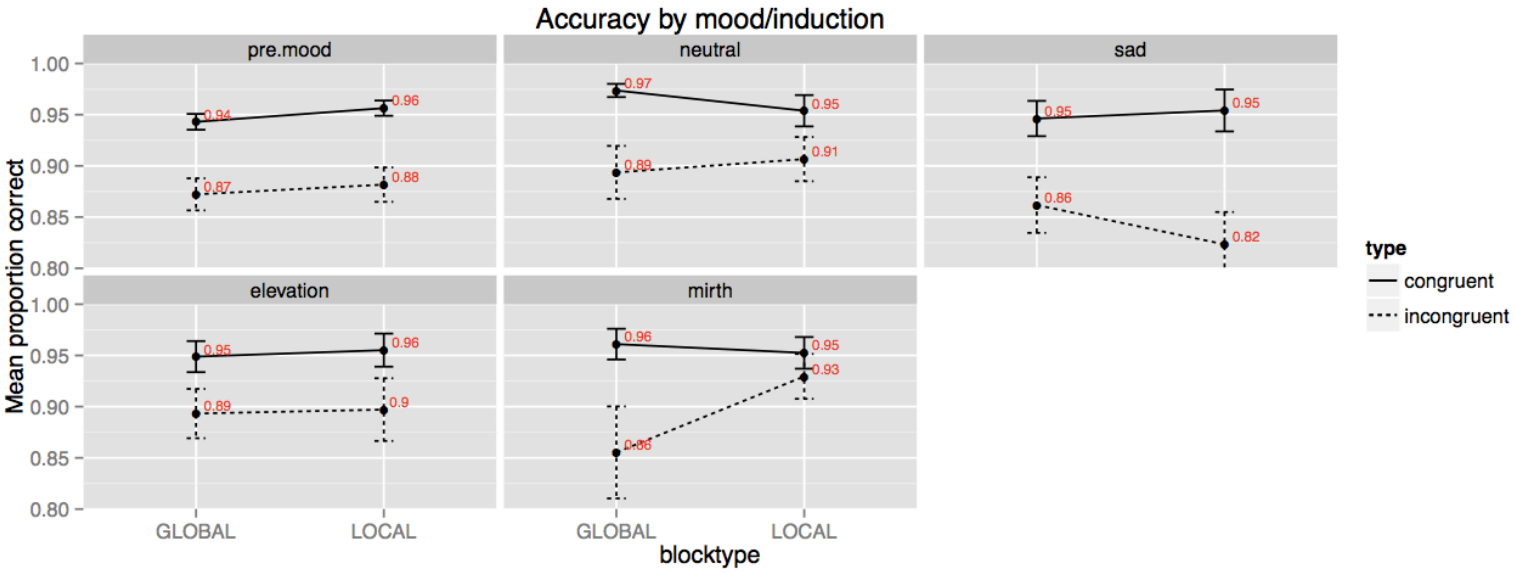

Figure 8. Proportion of correct responses in trials before mood induction and after in each respective mood condition in each block-type and trial-type. Participants under mirth had a higher level of accuracy in the local condition than global in incongruent trials, yet this kind of increase is not seen in other moods.

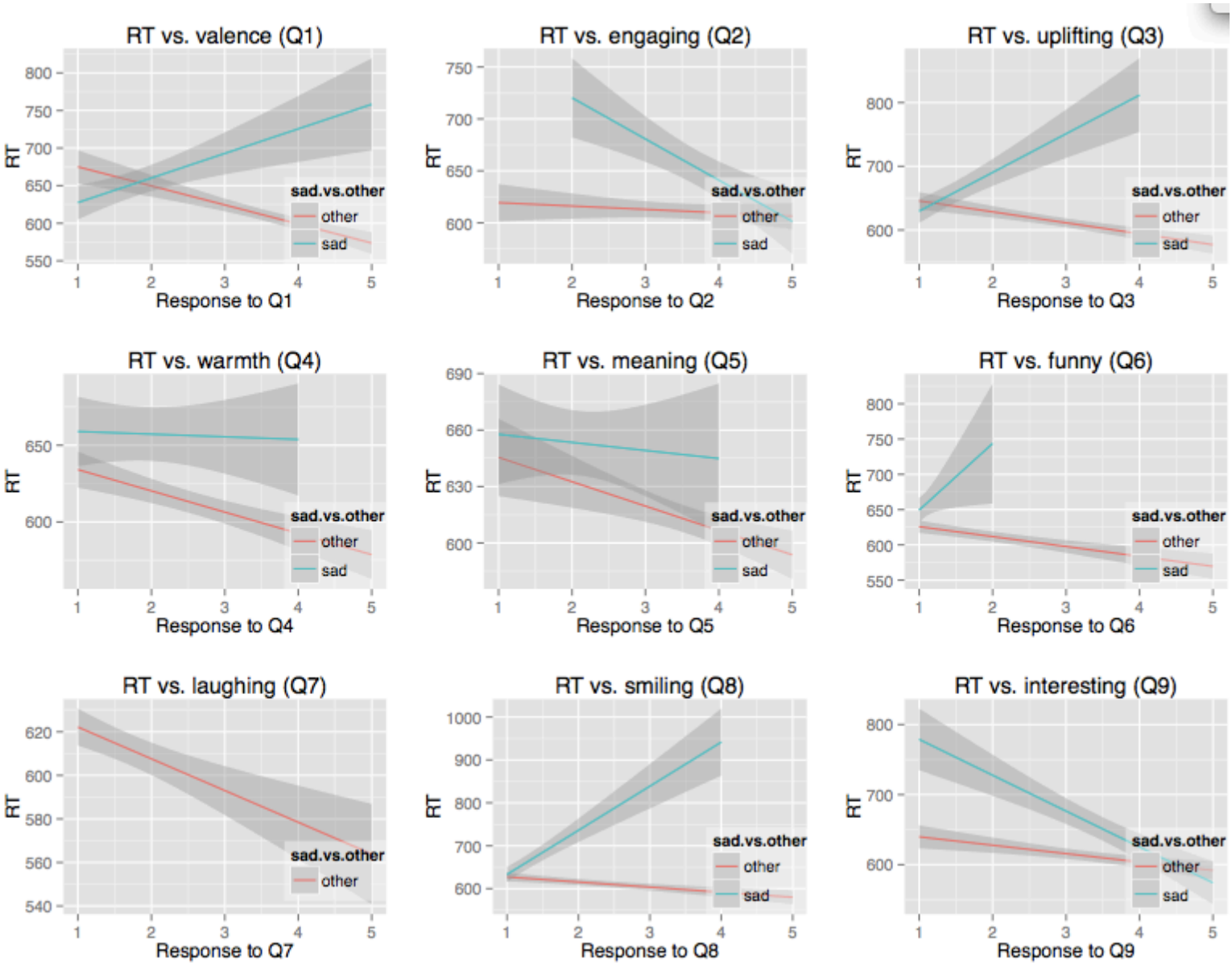

Figure 9. Reaction times against ratings in response to the mood questionnaire separated by sadness and other 3 mood conditions. Interestingly, the less a participants rating matches their mood intensity, the quicker the reaction time. High positive ratings and high negative ratings lead to quicker reaction times.