"*These Two Alibis Seem Equally as Weak Compared to Those*"

Contrast and Condensation Effects in Inferential Judgments

by

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Abstract

Do contrast and condensation effects exist in the cognitive, inferential realm? This study examined the possibility using an existing experimental model designed to assess these effects in the sensory and hedonic fields, replacing hedonic stimuli (juice tasting) with inferential judgment stimuli (alibi strength ratings). In the first experiment, testing for contrast, both test alibis were rated weaker after the participants had read strong context alibis, although only one was significantly affected. In the second experiment, testing for condensation, the inferred difference in strength between the two test alibis did not change after participants read the strong context alibis from when they only rated the test alibis. However, when examining the data from the first experiment, the absolute difference between the two test alibis diminished significantly when the strong alibis were first considered. This provides plausibility that contrast and condensation effects both occur for inferential judgments.

Keywords: Contrast Effect, Condensation Effect, Cognitive Inference, Alibi Strength

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Introduction

For decades, researchers have been examining contrast and assimilation effects in a wide variety of fields, from psychology to economics. These effects have been investigated particularly in sensory and social psychology. The contrast effect can be defined as an increase in the perceived difference between two or more stimuli of different intensities. These stimuli can be presented together or consecutively, both of which can produce a contrast effect. For example, a face will be judged as less attractive if it is presented after a very attractive face, rather than judged alone. Similarly, a sound will be perceived as louder if it is preceded with softer sounds, whereas the same sound will be perceived as softer if it is preceded by louder sounds. Even if the present research examined contrast effects in the field of legal psychology, the first section of this thesis is devoted to an overview of findings in the fields of sensory and social psychology.

Contrast effects are often accompanied by other psychological effects. Wedell, Parducci, and Geiselmen (1987) examined the presence of a contrast effect in judging physical attractiveness and whether it can be present with an effect called simultaneous assimilation – the idea that a stimulus (such as a face) will be judged more attractive when it is presented simultaneously with other attractive stimuli (other faces). It is, in other words, a paradoxical effect to the contrast effect – where a stimulus is judged as being less attractive when it is presented with other attractive stimuli. Assimilation effects have been studied well prior to 1987, with prominent works being published in the late 1950s. Campbell, Hunt, and Lewis (1957) found that different contextual clues, when presented simultaneously to a test stimulus, can alter the judgment of the test stimuli. Shortly thereafter, Sherif, Taub, and Hovland (1958) showed that both assimilation and contrast effects

can be found within the same experiment, depending on the likeness of the contextual "anchor" to the actual test stimuli. This was done in a sensory experiment, where participants were asked to judge the difference in incremental weights placed in front of them. When the "anchor" weight was lighter than the lightest test weight, the lighter weights were judged to be closer to the anchor weights (assimilation), while the heavier weights were judged to be heavier (contrast). When the anchor weight was heavier than the heaviest test weight, the lighter weights were judged as lighter than before (contrast), while the heavier weights were judged as closer to the heavy anchor weight (assimilation).

Continuing in the realm of cognitive judgments, McMullen (1997) examined the relationship between factual and counterfactual thinking and the contrast and assimilation effects. Participants were asked to recall an autobiographical event where they were subjected to a "close call" scenario. This could be a car accident, an injury, or anything else that is viewed as negative by the participant. They were then asked to focus on both the counterfactual and factual happenings of the event. Participants who were asked to focus on the counterfactual events (what could have happened if…) judged their counterfactual event as closer to reality, while the group told to focus on the factual event (what actually happened) judged the factual event as further from the real event, both in relation to their initial judgment of the event (McMullen, 1997). This indicates an assimilation effect when people are focusing on the counterfactual, and a contrast effect when people are focusing on the factual (McMullen, 1997).

Shortly afterward, Bless and Schwarz (1998) published research showing that merely bringing contextual evidence to mind prior to the test question being asked can influence the participant's judgment on a given matter. They asked some participants to judge a political party after having

been reminded of a highly respected politician belonging to this same party. When it was mentioned that the politician would take part in political affairs for that party, the party was judged more positively (assimilation). When it was mentioned that the prominent politician would be excluded from the party, the party was judged more poorly, creating a contrast (Bless & Schwarz, 1998).

This leads to more recent work being done on the credibility of information sources and its impact on contrast and assimilation. Tormala and Clarkson (2007) demonstrated that priming the participants with different information regarding the information source can also cause a contrast effect. The participants were given a persuasive message and asked to judge its persuasiveness. Participants were given a piece of completely unrelated information from a high-credibility source or a low-credibility source. When given the prior information by the low-credibility source, participants' attitudes were more favorable toward the target piece of information (Tormala & Clarkson, 2007). This indicates that there exists a contrast where the participants judge the persuasive message as more believable because it comes from an apparently more believable source after being primed with a poorly credible source first. The same holds true for the opposite, where messages are considered less credible when participants are first presented with more credible sources (Tormala & Clarkson, 2007).

Research has shown that giving people prior knowledge, both related and unrelated to the task at hand, can influence their sensory and cognitive judgments. Kobylińska and Karwowska (2014) argued that contrast effects happen due to priming, mainly as a response to implicit emotional regulation. As the subconscious tries to avoid creating biases after having been primed, it can overcompensate in regards to neutral objects, thus creating a contrast effect (Kobylińska &

Karwowska, 2014). This subconscious effort to avoid bias can help explain a contrast effect seen in expert versus non-expert opinions. Bohner, Ruder, and Erb (2002) noted both a contrast effect and an assimilation effect when examining message expectancies, depending on whether the message was conveyed by an expert or a non-expert. When the expert message was clearly different from what was expected, a contrast effect was seen between what the expected message was and how the actual message was perceived (Bohner et al., 2002). An assimilation effect was found when the message was ambiguous, suggesting that people subconsciously assimilate expert opinions to match what their preconceived notions of a certain message were (Bohner et al., 2002). They also noted that negative contrast in relation to positive expectancies "were unequivocal and stronger" than positive contrast in relation to negative expectancies (Bohner et al., 2002). In simpler terms, when expectations are high, the contrast effect makes a negative outcome seem worse; in turn, when expectations are low, the contrast effect makes a positive outcome seem better.

All cognitive contrast effects can be simplified to include two parts: A judgment made upon a target while comparing it (whether consciously or subconsciously) to an anchor (Biernat, Kobrynowicz, & Manis, 1997). When examining the contrast effect in social psychology, research demonstrates that a contrast effect is most apparent in five main scenarios: When the target is average or unfamiliar to the judge, when the environment or context surrounding the judgment is homogeneous or negative, or when the judge has sufficient cognitive resources to further compare the target and the anchor (Palmer & Gore, 2014). This, in turn, explains why persuasive arguments are more effective when the contrast toward a previously held opinion is lesser. Sarup, Suchner, and Gaylord (1991) used various pro-choice messages given to a group of pro-life organisations

to examine how persuasion can be more, or less, achieved, depending on the amount of contrast found in the opinion. They found that when the message was only moderately contrasting with the pre-existing knowledge of the pro-life group, the participants' attitude shifted toward that of the pro-choice message. When the message was more contrasting to the participants' pre-existing notions, it was found to be less persuasive and shifted participants' attitudes away from the message (Sarup et al., 1991).

In social and sensory judgment experiments, both contrast and assimilation effects are found. This means that a fine line rests between the anchor and the target, where a target similar to the anchor will be assimilated, while a target different from the anchor will be contrasted. Mussweiller (2007) explains that whether or not a comparison leads to assimilation or contrast is not dependent on the task itself, but rather on the comparison processes in the person's subconscious. If the task does not explicitly ask for a comparison between target and anchor, a person's subconscious will automatically compare the two, and the level of similarity between the two will determine which of the two effects will prevail (Mussweiller, 2007).

Sensory and Hedonic Contrast Effects

Sensory contrast occurs when more intensive stimuli are presented along with less intensive stimuli on a given continuum. For instance, hearing loud sounds makes soft sounds softer (Zellner, Allen, Henley, & Parker, 2006). Contrast effects also occur for hedonic judgments. Seeing attractive bird pictures makes unattractive bird pictures even more unattractive (Zellner, Rohm, Bassetti, & Parker, 2003).

Hedonic contrast has also been studied in the field of music, where bad musical selections and good musical selections are interchanged to influence hedonic preference (Parker, Bascom, Rabinovitz, & Zellner, 2008). The authors found both positive and negative contrast effects depending on which musical selection was heard first. If the good musical selection was heard first, the bad musical selection was judged as worse than if the same bad musical selection was heard on its own. The same principle was found when the good musical selection was played after hearing the bad musical selection first. Parker et al. (2008) conclude that this gives some scientific reasoning to the notion of "being a tough act to follow". In the same line, Wedell, Parducci, and Geiselman (1987) found that when pictures of less attractive faces were shown successively, followed by the test picture, the test face was judged to be more attractive. They coined this effect *successive contrast*. Hedonic contrasts extend to self-attractiveness as well. Studies show that people judge themselves as more attractive when they are surrounded by less attractive people. The opposite is also true when they are surrounded by more attractive people (Thornton & Moore, 1993).

Condensation Effects in Sensory and Hedonic Judgments

Sensory and hedonic contrasts are accompanied by a related phenomenon called *condensation*. The condensation effect can be described as a diminishing of the perceived difference between two stimuli at the lower end of a given continuum after exposure to stimuli at the upper end of the continuum. Condensation effects have been observed in sensory experiments. Hence, loud sounds not only make soft sounds softer, but they also make them less discriminable; their loudness difference is reduced (sensory condensation). Parker, Murphy, and Schneider (2002) found a

condensation effect in an auditory experiment where their participants perceived four auditory stimuli as less different from each other when they were presented with a fifth, louder stimulus.

Condensation effects also extend to hedonic judgments. Attractive bird pictures not only make unattractive bird pictures even more unattractive, preference for one unattractive bird picture over the other is also reduced (hedonic condensation). Zellner, Allen, and Henley (2006) showed that a condensation effect emerged in a contrast experiment when participants tasted a series of full-strength juices and diluted juices. They presented participants with three pairs of commercial fruit juices and asked them to rate their preference for one juice over the other. The first two pairs were full-strength juices, used to establish a contrast effect with a third pair of, this time, diluted juices. Zellner and colleagues reported that when the two pairs of full-strength juices were tasted before the pair of diluted juices (Experimental group), the preference for one diluted juice over the other was significantly lesser than when the two diluted juices were tasted alone (Control group).

Our Research

Although contrast effects have been reported previously in the cognitive realm, we are not aware of any study reporting a “cognitive” condensation effect, as widely observed in the sensory and hedonic realms. This presents the possibility for further investigations. The aim of the present thesis was to provide a first step toward closing this knowledge gap in the field.

Our research was aimed at whether or not contrast and condensation effects were present during a cognitive inference task. Consider the following: A participant is given to read a series of statements (e.g., from politicians, from job candidates, from public health authorities) and asked

to infer on their strength. Would weaker arguments presented after strong arguments be perceived as weaker (cognitive contrast effect)? Would the inferred strength difference between two weak arguments be reduced when pairs of strong arguments are first considered (cognitive condensation effect)?

Pepitone and DiNubile (1976) examined the perceived judgment on the severity of a crime and the magnitude of its punishment. When participants were asked to judge the severity of a lesser crime, in this case an assault, before being asked to judge the severity and punishment of a homicide, participants tended to judge the homicide more severe and sought a harsher punishment than when the first crime was also a homicide (Pepitone & DiNubile, 1976). This would indicate that priming, whether intentional or not, can have a major effect on the presence of a contrast effect and, therefore, on the cognitive judgments of a given topic. As that study provided evidence that a contrast effect has been observed in the field of legal psychology pertaining to the judgment of crime, we felt justified in using a legal context for our study, changing from the magnitude of punishment to the strength of alibis.

The inference judgments used in our research were post-crime alibis given to mock detectives (participants) by suspects of said crime. Participants were asked to make a judgment on the alibis' strength. Alibis varied in strength along a least-to-most believable continuum, based on criteria established by Olson and Wells (2004). If alibis vary in strength depending on their makeup, there is then a possibility of a contrast effect and a condensation effect when multiple alibis of varying strength are considered within the same experiment.

Our goal was to replicate the two experiments conducted by Zellner et al. (2006), the first experiment testing the possibility of a contrast effect and the second experiment testing the possibility of a condensation effect, replacing full-strength and diluted juices with strong and weak alibis, respectively. Our research unfolded into three steps: firstly, a pilot study was needed to evaluate the strength of a selection of alibis covering the whole spectrum of a less-to-more believability continuum; secondly, a first experiment to determine if weak alibis are judged even weaker when strong alibis are rated first (a contrast effect); thirdly, a second experiment to test whether or not the expected contrast effect is accompanied by a condensation effect, in other words, a reduced difference in believability between two weak alibis when pairs of strong alibis are compared first.

General Methods

The research protocol was approved by Laurentian University's Research Ethics Board (Certificate #6020942, see Appendix C).

Participants for all three parts of this study were recruited using Laurentian University Department of Psychology's Online Research Participation Pool (SONA). SONA allows researchers in psychology to post their studies online to recruit participants. The participants are undergraduate students from various faculties who are enrolled in a course which the professor has registered for SONA. The participating students are rewarded for participation by receiving bonus marks toward their final grade or the participating course, up to a maximum of 3%. The researcher can set the amount of bonus percentage the student will received based on the approximate amount of time it will take them to complete the study (0.5% per half-hour).

Using SONA, we recruited a total of 105 participants for our three experiments (Pilot Study, Experiment 1, Experiment 2). Within SONA, we were able to implement constraints on study registration allowing us to ensure that prospective participants were only permitted to register for one of the three experiments. Once the participant selected our study from the available studies on SONA, they were taken to a Google Form on which they were given instructions on the task. Once they agreed to participate, they proceeded to the questionnaire portion of the Google Form where they made their judgments on our alibis, before submitting the form. No identifying information apart from participant age was collected, although a prompt for an email address was available if the participants wished to receive a summary of the results of this study. This information was kept separately from their questionnaire answers.

Pilot Study

To emulate Zellner et al.'s (2006) hedonic judgment study, where juices were used, a pilot study was conducted to identify four strong context alibis and two weak (test) alibis. The alibis considered for this study were taken from Olson's (2002) Master's thesis pertaining to the believability of alibis based on their contents. With their work, Olson was able to taxonomize 36 different alibis (see Appendix A for a complete listing of alibis), from least believable to most believable, using two metrics: physical evidence and person evidence.

Physical evidence was determined to be the predominant factor in the believability of an alibi. Physical evidence is defined as an object, such as a video or a receipt, that can corroborate an alibi. This evidence can be divided into three distinct categories: no physical evidence, easy-to-fabricate physical evidence, and difficult-to-fabricate physical evidence. Items such as receipts for items paid in cash are classified as easy to fabricate, whereas evidence such as security video footage is classified as difficult to fabricate.

The second axis of alibi believability is person evidence. Person evidence relies on witnesses. Olson and Wells (2004) divided this axis into four categories with varying degrees of believability: The witness is either familiar with the suspect (e.g., a family member or a bartender in a regularly attended bar) or a stranger to the suspect, and the witness is either motivated to protect the suspect (e.g., a sibling or a parent wanting to protect their family member), or non-motivated to protect the suspect (e.g., a cashier or a waitress with no motive to protect the suspect). If a witness statement is found to be false, then the witness had either lied or they were mistaken. The authors developed

a bi-axel table to further facilitate the visualisation of alibi believability along both interlaced continua (Figure 1).

	Physical Evidence		
Person Evidence	None	Easy to Fabricate	Difficult to Fabricate
None	Least believable		
Motivated Familiar Other (easy to fabricate, not likely mistaken)			
Non-Motivated Stranger (difficult to fabricate, but possibly mistaken)			
Non-Motivated Familiar Other (difficult to fabricate, not likely mistaken)			Most believable

Figure 1. A taxonomy of alibi believability (Olson & Wells, 2004).

Olson and Wells' (2004) alibis were created from possible suspects to a fictitious crime. The description of the crime was presented in the form of a police report, with names and identifying details blacked out to provide a more authentic look to the document (Figure 2).

GENERAL INCIDENT REPORT

INCIDENT NO.	REPORTING OFFICER/BADGE	TIME/DATE REPORTED	TIME OF INCIDENT	DATE OF INCIDENT
M-9768-1-NED	Smith #92	8:45 pm [redacted]	8:00 pm	[redacted]

INCIDENT TYPE	INCIDENT ADDRESS
Armed Robbery, Assault	[redacted]

At approximately 8pm a man in a black raincoat entered the convenience store (approximately 15 minutes from the city's south edge) and began pacing the aisles. The teenage clerk, [redacted], was busy with several other customers and didn't notice him until after the customers left the store. As the clerk turned to help him, the man pulled a pistol from his coat pocket and demanded that she empty the cash register into a grocery sack. [redacted] did as she was told and fumbled with the cash register while the gunman waved the gun and shouted. When the full-service bell rang he roughly grabbed the sack, shoved [redacted] against the counter, and ran for the side door. When he discovered it was jammed, he smashed his way through it and ran off.

I arrived shortly after the clerk called in and took her statement and description of the gunman (see attached memo). [redacted] does not remember the gun type or description of the weapon. There were no other witnesses and no security tape. Suspect made off with about $250 cash and several bottles of liquor, estimated value $55. Where the suspect had broken the door I found several drops of blood, which were collected for possible DNA evidence.

SUPPLEMENTAL REPORT

INCIDENT NO.	REPORTING OFFICER/BADGE	DATE
M-9768-1-NED	Jones #141	[redacted]

This case is now several months old and any advantage we may have had with finding fresh scars on the hands or arms of possible suspects is gone. The case now has ten suspects, all of whom fit the witness's description, and all own black coats similar to the one [redacted] described. Witness was shown a live lineup containing the ten suspects, and was unable to determine which was the gunman. Witness was no help. Alibi investigation in progress.

Figure 2. Police report given to the participants before they rated the alibis. From Olson (2002).

For the pilot study, three alibis were selected for each of the 12 taxonomical categories. The objective was to have participants rate the alibis on a 201-point linear scale, adapted from Zellner et al. (2006). To avoid floor and ceiling effects, the alibis in the top left corner of the table (*Least believable*) and the alibis in the bottom right corner of the table (*Most believable*) were excluded. However, they were included as reference points at both ends of the scale: One of the three least believable alibis (alibi 7) was chosen to represent the –100 point on the scale, and one of the three most believable alibis (alibi 36) was chosen to represent the +100 point on the scale. These two alibis were labelled as "The Weakest Alibi Imaginable" and "The Strongest Alibi Imaginable", respectively. The middle point on our scale was labelled "Neither Weak Nor Strong". Because our two exemplars of weakest and strongest alibis differed in length (the strongest alibi being longer), non-influencing details (22 words) were added to the "Weakest" alibi exemplar to match the length of the "Strongest" alibi (additional words underlined in Appendix A).

The 30 remaining alibis were rated on our 201-point linear scale. To avoid mental fatigue from the participants, the 30 alibis were divided into three groups. Each group contained 10 target alibis – one from each of the remaining 10 taxonomic categories (squares in Figure 1). Participants were randomly assigned to one of the three Pilot groups.

Methods

Participants

Thirty participants from undergraduate psychology courses (average age: 21.5 years old) were recruited for the Pilot Study using SONA.

Procedure

The three versions of the Pilot study, each containing a different set of alibis (Appendix B), were created. The order of presentation of the alibis was randomized to avoid any bias and to minimize the risk of any contrast effects during pilot testing. Each version was delivered to participants using Google Forms. Forms is set to collect data anonymously, with only the participant's age being recorded, for research purposes. Each Form was sent out to ten participants, bringing the total participant pool to 30 for the pilot study. Participants were asked to read the following instructions then proceed with rating the 10 presented alibis:

You are now invited to read the following 10 alibis. These alibis vary from one another. We ask that you judge their strength based on their believability using the scale depicted below each suspect's alibi.

Please read carefully the following two examples; one is of the weakest alibi imaginable, the other is of the strongest alibi imaginable. If you judge the suspect's alibi as weak, rate it between –100 and 0. If you judge the suspect's alibi as strong, rate it between 0 and +100.

The example of the weakest alibi imaginable and the example of the strongest alibi imaginable will always appear above and below the suspect's alibi.

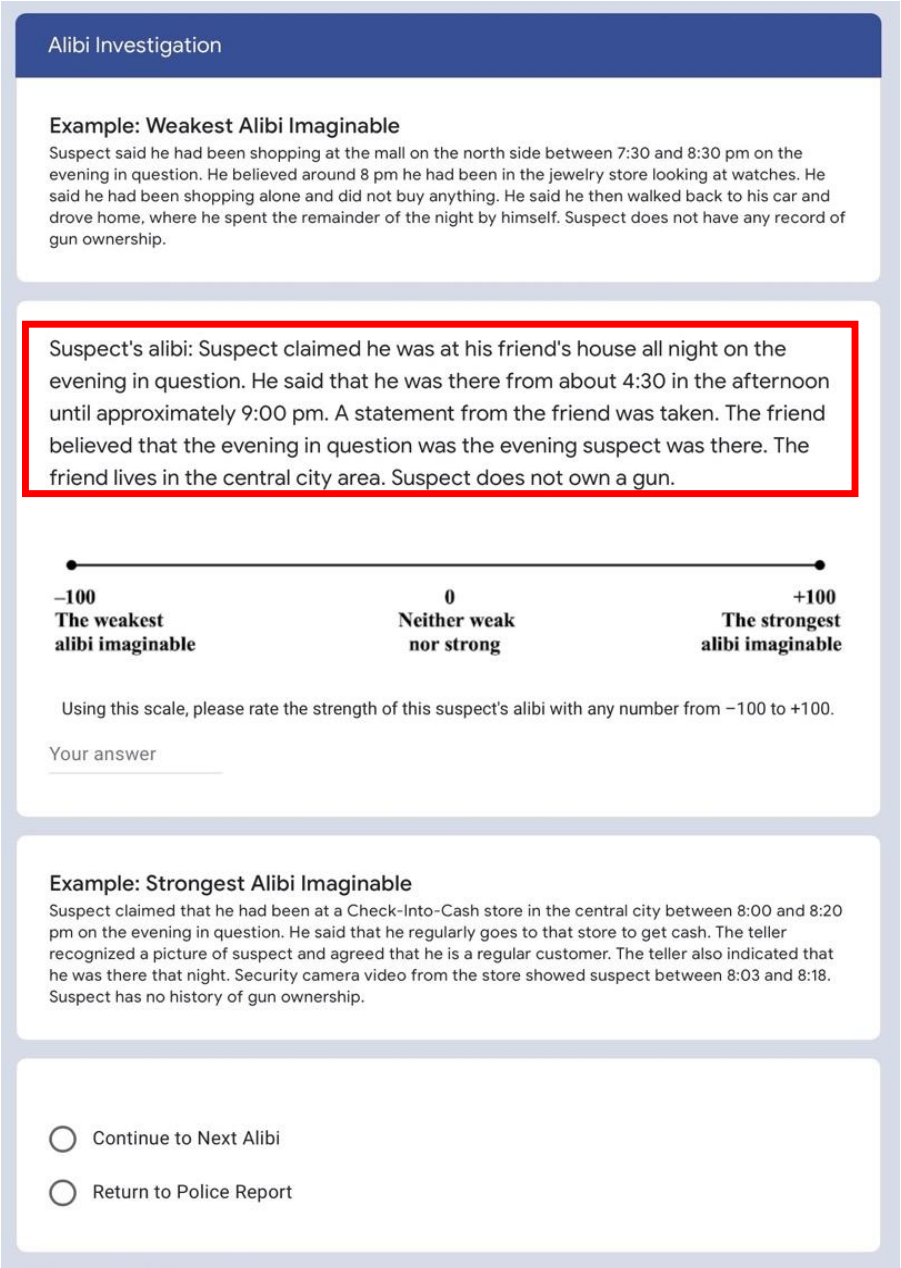

Figure 3. Example of the alibi pilot testing Google Form.

After the introduction and police report, the participants were shown 10 pages similar to Figure 3, one at a time, and asked to rate the strength of the target alibi, in comparison to the examples of the Strongest Alibi Imaginable and the Weakest Alibi Imaginable. The only change from one page to the next was the target alibi, shown here with the red frame (the red frame was not part of the actual Form).

Results

To get a more level and accurate comparison of the collected data, each alibi rating was standardized using a *z*-score based on the ten alibi ratings from each individual participant. Standardization was necessary, as each individual participant rated alibis differently. For example, although the mean alibi rating for all participants and for all alibis was +22.32, some participants rated alibis with a standard deviation of 24.38 while others had a standard deviation of 66.27. Standardization was further justified as the range of rating was as narrow as 40 for some participants and as wide as 140 for others. The standardized ratings were averaged over the 10 pilot participants, and then inserted within the taxonomy table according to which category they fell into.

	Physical Evidence		
Person Evidence	None	Easy to Fabricate	Difficult to Fabricate
None	Alibi 1: Not piloted Alibi 4: Not piloted Alibi 7: Not piloted	Alibi 2: -0.540 Alibi 5: -0.682 Alibi 8: -0.853 Average: -0.692	Alibi 3: -0.605 Alibi 6: -0.680 Alibi 9: -0.510 Average: -0.599
Motivated Familiar Other (easy to fabricate, not likely mistaken)	Alibi 10: -0.535 Alibi 13: -0.377 Alibi 16: -0.794 Average: -0.569	Alibi 11: -0.418 Alibi 14: -0.644 Alibi 17: -0.554 Average: -0.539	Alibi 12: -0.014 Alibi 15: -0.258 Alibi 18: -0.424 Average: -0.232
Non-Motivated Stranger (difficult to fabricate, but possibly mistaken)	Alibi 19: 0.026 Alibi 22: -0.188 Alibi 25: -0.173 Average: -0.112	Alibi 20: -0.053 Alibi 23: 0.574 Alibi 26: 0.521 Average: 0.347	Alibi 21: 1.572 Alibi 24: 1.578 Alibi 27: 1.419 Average: 1.523
Non-Motivated Familiar Other (difficult to fabricate, not likely mistaken)	Alibi 28:0.041 Alibi 31: 0.150 Alibi 34: 0.584 Average: 0.259	Alibi 29: 0.526 Alibi 32: 0.528 Alibi 35: 0.784 Average: 0.612	Alibi 30: Not Piloted Alibi 33: Not Piloted Alibi 36: Not Piloted

Figure 4. Taxonomy of alibi believability with standardized ratings for each of the 30 target alibis. The average standardized rating for each category is also included. Alibis in red are the strong context alibis, and alibis in yellow are the two test alibis. Alibi numbers refer to alibis listed in Appendix A.

Alibi Selection

Multiple factors were taken into consideration while identifying four strong context alibis and two test alibis to use in both Experiments 1 and 2.

To obtain a contrast effect in Experiment 1, the test alibis could not be alibis rated too low. In other words, the alibis needed "room" to move toward the left end of our bipolar scale when prefaced with alibis rated further on the right end. We did not want to use two test alibis with *z* scores too similar as this might make it difficult to see a condensation effect in Experiment 2. In other words, we wanted to leave "room" between the two test alibis to allow for them to be condensed. On the other hand, using test alibis with too big a difference in *z*-scores could potentially lead to an unintended contrast effect within the experiment itself. In addition, we needed two test alibis made up of different stories. We decided none of the weak alibis would include difficult to fabricate physical evidence. Although some of these alibis had lower *z*-scores, the physical evidence was notably more polarizing than the person evidence. The two test alibis chosen were the two with the furthest average *z*-scores – alibis 8 and 11. This would serve two purposes. First, it would ensure that if there is a contrast effect in Experiment 1, it would be seen on even the lowest rated alibi. Second, a wide gap between the two alibis used in Experiment 2 gave the most opportunity for a condensation effect to occur.

The four strong alibis chosen were the three strongest alibis rated – alibis 21, 24, and 27 – as well as the alibi used as our exemplar for the strongest alibi imaginable – alibi 36 (see Figure 5).

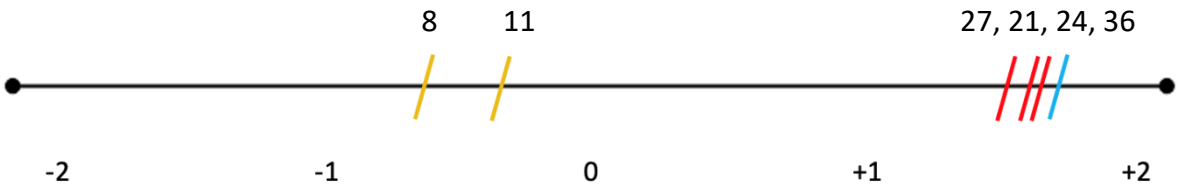

Figure 5. Selected alibis represented on a standardized, z-score scale. Yellow dashes represent the weak test alibis (alibis 8 and 11), and red dashes represent the strong context alibis (alibis 21, 24, and 27). The fourth strong context alibi (alibi 36), represented by the blue dash, was not part of the pilot testing, although we assume the rating to be about the same as the three other strong alibis.

Experiment 1

The purpose of this experiment was to establish that a contrast effect can be obtained with inferential judgments made on alibis' strength. This is an important first step, as most condensation effects in hedonic judgments are obtained with contrast-inducing stimuli. When strong alibis are judged before two weak (test) alibis, the test alibis' ratings should be pushed over, towards the left end of the strength scale. This would match the findings in Zellner et al.'s (2006) Experiment 1, where participants in the Experimental group were first given four full-strength juices to taste, followed by the two diluted (test) juices, with the test juices rated as significantly lower, on the hedonic scale, compared to the Control group.

Methods

Participants

A total of 39 undergraduate students from Laurentian University, averaging 23.2 years of age, were recruited on SONA for voluntary participation in Experiment 1. The data from four participants were excluded from the analysis because they did not follow instructions properly. The remaining 35 participants were randomly assigned to either the Experimental (n = 18) group or the Control (n = 17) group.

Procedure

The procedure followed Zellner et al.'s (2006; Exp. 1) experiment regarding hedonic contrast, replacing full-strength and diluted (test) juices with strong and weak (test) alibis, respectively, to explore contrast in terms of alibis' strength. All participants first read a police report describing a mock crime, taken from Olson (2002; see Appendix A). This was a fictitious rendering of a crime consisting of a jewelry theft from a town mall, made to look as authentic as possible. This report was written on an official-looking police report form and included descriptive details about the suspect in question, with certain identifying details blacked out to add authenticity. After acknowledging they read and understood the report, they proceeded to the alibi judgment portion of the study. The strength judgments were made on the same 201-point scale previously used in the Pilot study, with the left end representing the weakest alibi imaginable (−100) and the right end representing the strongest alibi imaginable (+100). Unlike the Pilot study, the to-be-judged alibis were not bracketed by exemplars of the weakest and strongest alibis imaginable.

The Experimental group was presented with four contextual strong alibis (21, 24, 27, 36), presented in that order, followed by the two weak (test) alibi (8 and 11), each presented one at a time. A contrast effect was expected in this group. Participants in the Control group were presented with the two weak (test) alibis (8 and 11) only. In both groups, the two test alibis were presented in a counterbalanced order to prevent an order of presentation bias.

Results

To see a defined contrast effect, the two weak (test) alibis would need to be rated as weaker in the Experimental group than in the Control group. Mean strength ratings for each alibi are presented in Table 1. As can be seen in Figure 6, participants in the Experimental group did seem to provide weaker ratings for the two weak (test) alibis when compared to the Control group.

	Strong Alibis	**Combined Strong Alibis**	**Weak (Test) Alibis**	**Combined Weak (Test) Alibis**
Experimental Group	21: 46.50 (55.30)	57.22 (42.39)	8: 2.78 (53.72)	7.50 (43.63)
	24: 69.17 (41.95)		11: 12.22 (54.89)	
	27: 66.83 (53.00)			
	36: 46.39 (55.70)			
Control Group			8: 7.65 (44.09)	33.53 (35.90)
			11: 59.41 (36.69)	

Table 1. Mean (standard deviation) strength ratings for strong and weak (test) alibis, both individually and combined, for both groups.

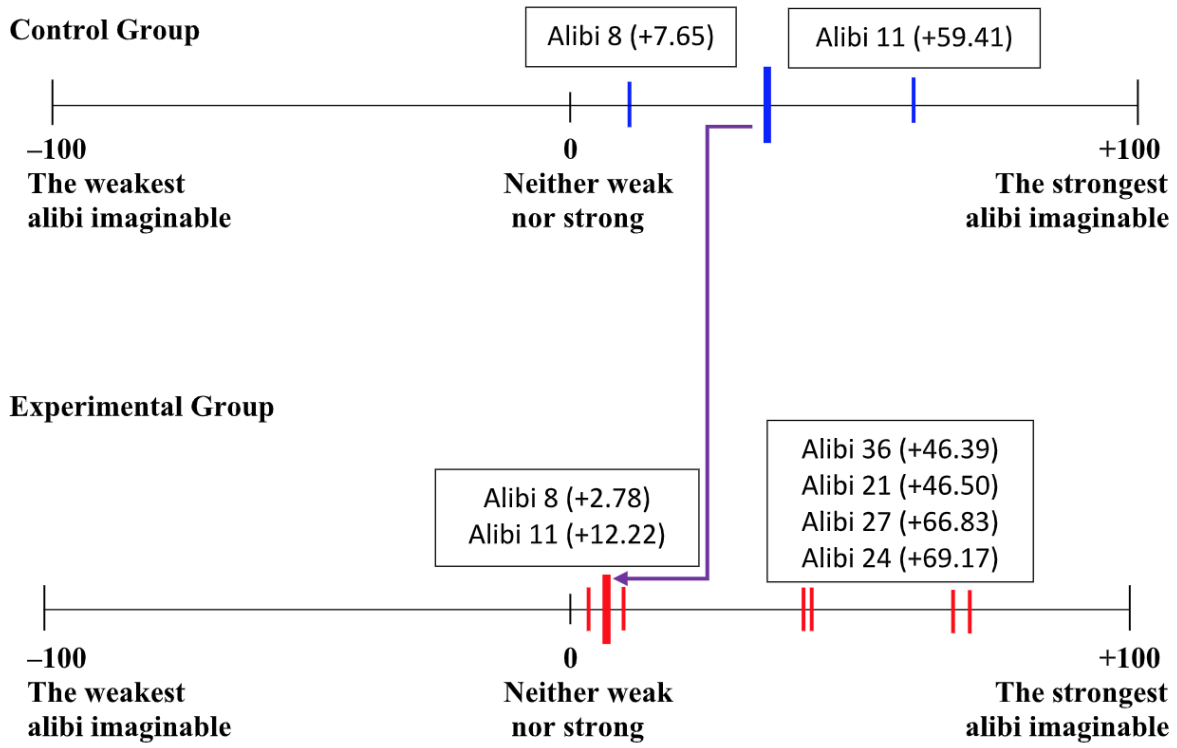

Figure 6. Experiment 1 results shown on the 201-point rating scale. Alibi numbers are followed by their average rating in parentheses. Thin vertical lines represent the average rating for each alibi. Bold vertical lines represent the combined average rating of the two weak (test) alibis, for each group. The purple arrow depicts the contrast effect seen in this experiment.

For each participant in each group, the ratings of the two weak (test) alibis were combined, following Zellner et al. (2006; Exp. 1). Average combined ratings are shown as the bold red bar (Experimental group) and the bold blue bar (Control group) in Figure 6. As shown by the purple arrow, a shift towards the left end of the scale is visible for combined ratings (bold vertical bars). However, as ratings for alibi 8 are very similar between the two groups, this shift seems to be

mostly driven by alibi 11. The following analysis confirmed that pattern. As these judgments were made using a cardinal (ratio) scale, a *t*-test would be the appropriate statistical determinant of significance. However, the normativity and homogeneity of variance assumptions were not met for all our data samples. Therefore, a Mann-Whitney non-parametric *U*-test was chosen. A first Mann-Whitney test did not demonstrate a significant difference in the combined ratings of the two weak (test) alibis between the Experimental group (M = +7.50) and the Control group (M = +33.53), $U = 96.5$, $p = .062$. As suspected, a second Mann-Whitney performed on the ratings of alibi 8 showed no significant difference between the Experimental group (M = 2.78) and the Control group (M = +7.65), $U = 143.5$, $p = .75$. On the other hand, a significant difference was found for the ratings of alibi 11 between the Experimental group (M = +12.22) and the Control group (M = +59.41), $U = 70.5$, $p < .01$.

Discussion

When weak (test) alibis were preceded by contextual strong alibis (Experimental group), one of the two test alibis was judged to be weaker than when the two test alibis were judged alone (Control group). These results partially parallel those of Zellner et al. (2006) on hedonic contrast, where diluted juices (weak test stimuli) were rated as less hedonically positive when the participants sampled full-strength juices (strong stimuli) beforehand (Experimental group), as opposed to sampling only the diluted juices (Control group).

Now that we had partially demonstrated a contrast effect in inferential judgments, we sought whether this contrast effect was accompanied by a condensation effect as seen in Zellner et al.'s (2006) Experiment 2. Of note, although the purpose of Experiment 1 was to evaluate a contrast

effect, a condensation effect seems to be present in the data. In fact, not only were the ratings of the two weak (test) alibis shown to be pushed over, towards the left end of the strength scale, when strong alibis were considered first (Experimental group), but also at the same time, ratings of the two weak (test) alibi also tended to become more similar to each other. As shown in Figure 6, the distance between the two thin vertical red lines (Experimental group) was much closer than between the two thin blue ones (Control group). As an alternative measure of a condensation effect, the absolute difference between the ratings of the two weak (test) alibis was calculated for each participant. A Mann-Whitney *U*-test performed on the average absolute difference revealed a significant difference between the Experimental group (M = 38.89) and the Control group (M = 51.74), $U = 88$, $p < .05$. Such an outcome led us to expect a condensation effect to emerge in Experiment 2, when alibis were presented in pairs (the comparative task adapted from Zellner et al., 2006).

Experiment 2

The purpose of this experiment was to test whether a condensation effect can be observed for judgments of alibis' strength. The procedure differed slightly from Experiment 1. This time, the alibis were presented in pairs (rather than one at a time). After reading each pair of alibis, participants were asked to judge the extent to which one was stronger than the other. Participants in the Experimental group first read the four strong alibis, presented in two pairs, followed by the two weak (test) alibis, presented as a pair. Participants in the Control group only read the pair of two weak (test) alibis. This parallels Zellner et al.'s (2006) Experiment 2, where participants were given pairs of juice samples to taste and were asked to rate their preference for one juice over the other. Participants in the Experimental group were first given two pairs of full-strength juices to sample, followed by the pair of diluted (test) juices, while participants in the Control group were given only the two diluted juices.

If a condensation effect was to emerge for inferential judgments made on alibis' strength, the inferred strength difference between the two weak (test) alibis was expected to be lesser in the Experimental group than in the Control group. This should result in significantly more participants reporting a 0-value rating (no strength difference) in the Experimental group and significantly lower mean ratings (lower or condensed strength difference) in the Experimental group compared to the Control group.

Methods

Participants

Thirty-six Laurentian University undergraduate students, with an average age of 27.4 years, were recruited via SONA for voluntary participation in Experiment 2. They were randomly assigned to either the Experimental (n = 18) or the Control (n = 18) group.

Procedure

The procedure replicated that of Zellner et al.'s (2006; Exp. 2) experiment regarding condensation once again replacing the full-strength and diluted (test) juices with strong and weak (test) alibis, respectively. In Experiment 2, the alibis were presented in pairs, and the participants were tasked with judging the difference in strength between the two alibis of a given pair.

Participants in the Experimental group were tasked with reading six alibis presented in three separate pairs. The first two pairs were the strong context alibi (Pair A: alibis 21 and 24, Pair B: alibis 27 and 36). After having read and rated the difference between these strong alibis, the participants read the two weak (test) alibis (8 and 11), and they were asked the same two questions: is there a difference in strength between the two alibis (presented as a YES/NO question). If they answered "no" to the first question, a rating of 0 was recorded. If they answered "yes", they were asked to rate that difference in strength on a scale from 1 to 10 (Figure 7). The scale had 4 reference points vis-à-vis the 1, 4, 7, and 10 values, reading *slightly stronger, somewhat stronger, a lot stronger,* and *very much stronger,* respectively. Participants in the Control group were presented with a single pair of weak (test) alibis and tasked with rating the difference in strength between

the two, on the same 10-point scale. In both groups, the two test alibis were presented in a counterbalanced order to prevent an order of presentation bias.

Results

Of the 18 participants in the Experimental group, five noted no difference (rating of 0) between the two weak (test) alibis, while in the Control group, seven of the 18 participants noted no difference in strength (rating of 0). Of the participants in either condition who noted a difference in the strength of the alibis (n = 24), 21 indicated alibi 11 as the strongest alibi. In fact, as seen in Table 2, the pair of weak (test) alibis rated by the Experimental group had the largest average difference of all the rated pairs of alibis. As demonstrated in Figure 7, the average difference between the two weak (test) alibis did not differ much between the two groups.

	Strong Alibis (Pair A)	**Strong Alibis (Pair B)**	**Weak Alibis (Test Pair)**
Experimental Group	1.89 (2.42)	2.50 (2.77)	3.44 (2.96)
Control Group			3.33 (3.07)

Table 2. Mean ratings (standard deviation) of the difference in strength between the paired alibis.

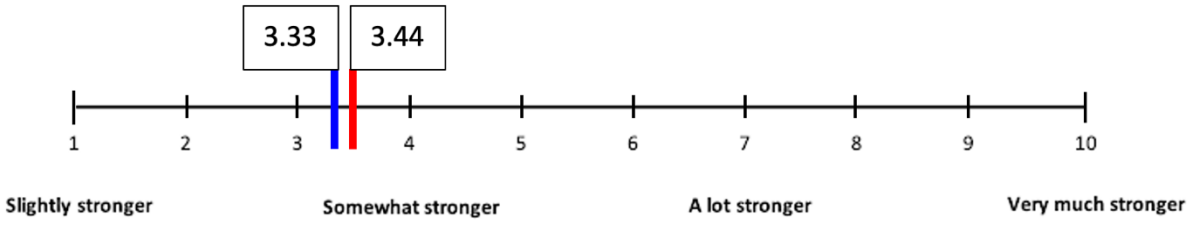

Figure 7. Experiment 2 results shown on the 10-point rating scale. The red and blue lines represent the average difference between the two weak (test) alibis in the Experimental group and the Control group, respectively.

A Mann-Whitney non-parametric *U*-test showed no significant difference in the strength difference rating of the two weak (test) alibis between the Experimental (M = 3.44) and the Control group (M = 3.33), U = 159, p = .92. Therefore, unexpectedly, no condensation effect arose in this experiment.

Discussion

When examining the presence of a condensation effect, we followed Zellner et al.'s (2006) methodology of using a comparative task. This was done to establish a parallel between hedonic and inferential judgments. However, we were unable to find supporting evidence for a condensation effect as measured this way. In turn, using alternative methods derived from the data collected in Experiment 1 (alibis presented individually, rather than in pairs), we were able to

unveil a condensation effect. When not asked directly to compare two alibis, participants indirectly condensed the strength judgments of the two weak (test) alibis.

It is worth noting that in prior studies in this field, paired comparative tasks were not often used in testing for a condensation effect. Most studies examined the effects of adding one or more strong stimuli on the ratings of weaker stimuli (e.g., Lockhead & Hinson, 1986; Parker et al., 2002). The participants were tasked with rating *single* test stimuli after exposure to varying arrays of context stimuli. This would indicate that while a paired comparative task is useful in hedonic judgments where one stimulus is compared explicitly to another, it does not necessarily translate well to the realm of inferential judgments, and other tasks should be considered as well.

General Discussion

Discussion

The purpose of this study was to examine the possibility of a contrast effect and a condensation effect within the cognitive, inferential realm of psychology. We based our procedure on Zellner et al.'s (2006) study on hedonic judgments of full-strength and diluted juices, replacing the juices with strong and weak alibis, respectively. Participants were tasked with reading the alibis and making a judgment on the strength of these alibis (Experiment 1) or on the difference in strength between a given pair of alibis (Experiment 2). In the first experiment, a significant contrast effect arose from one of our two test alibis between our Experimental group and our Control group. In addition, a condensation effect was evidenced in Experiment 1 when considering an alternative measure. On that basis, we proceeded with Experiment 2 to evaluate the possibility of a condensation effect, this time using Zellner et al.'s (2006) paired comparative task. Unexpectedly, no condensation effect emerged. The reported difference in strength between the two test alibis did not differ significantly between the Experimental and the Control group.

In Experiment 1, a contrast effect was observed only for one of our two weak (test) alibis. Although both alibis were rated as weaker, on average, in the Experimental group, only alibi 11 was rated significantly weaker compared to the Control group. A few possibilities as to why this was the case are now considered. During the alibi selection process (following the Pilot study), it was decided that our test alibis needed to conform to certain basic requirements. These included not sharing the same narrative as any other selected alibi and, more importantly to this point, for the

two weak (test) alibis having a rating sufficiently different from one another to give enough "room" for a condensation effect to emerge in Experiment 2. In other words, the two test alibis needed to be far enough apart (while still being weak) that they could be condensed. This led us to using alibi 8 and alibi 11 as our two test alibis. Alibi 11's rating during the Pilot study was average ($z = -0.42$) among the potential test alibis. Alibi 8, on the other hand, was the weakest rated alibi ($z = -0.85$). Although we did not pilot the alibis found in the top left corner of Olson and Wells' (2004) taxonomy (Figure 1) to prevent a floor effect, we may have inadvertently produced a floor effect by picking the weakest rated alibi. This is one of the plausible explanations as to why no significant contrast effect was noted for alibi 8 in Experiment 1.

The second possible reason as to the insignificance of alibi 8 is the location of this alibi in the taxonomy, compared to alibi 11. As discussed by Olson and Wells (2004), physical evidence is viewed as more compelling in alibi credibility than person evidence. Although both alibis were in the "no physical evidence" column, alibi 8 did not present any person evidence, while alibi 11 presented motivated familiar person evidence (the suspect was entertaining his brother at his home). The person evidence gives one more layer of credibility to the alibi and provides additional inferential details to the participant reading and rating the alibi and therefore allows for broader cognitive interpretation of alibi credibility. In studies relating to contrast effect, the test stimuli are often considered to be sensorially or hedonically neutral. For example, Zellner et al. (2006) used diluted juices as their test stimuli, instead of something with a foul taste. In our study, alibi 11 could be considered as a more neutral stimulus, having more layers of possible inferential judgments, whereas alibi 8 might be considered as too negative to be affected by contrast.

A further exploration into the difference between the average ratings of alibi 11 and alibi 8 in the first experiment serves as a good discussion point as to the lack of a condensation effect in Experiment 2. In their second experiment, Zellner et al. (2006) used diluted juices as their test stimuli. If we consider the make-up of the test juices, both were one third juice, two thirds water. We can interpret that as both test juices having a strength of 33% and the full-strength juices having a strength of 100%. The only difference between the juices was the fruit flavour. The only hedonic judgment needed from the participant was their preference in taste for one over the other. In our Experiment 1, alibi 11 was rated stronger than alibi 8 in both the Experimental group and the Control group. We therefore did not have equally weak alibis to use as our test stimuli. This also reinforces the notion that, although the test alibis were both rated weak ($z < 0$) in our Pilot study, having the additional layer of credibility due to the presence of person evidence seems to have played a critical role in alibi judgments.

Past studies have examined the manipulation of stimulus range, looking into how wide or how narrow the range between test timuli can be to still achieve a condensation effect. Lockhead and Hinson (1986) noted that if the stimuli were too far apart in range, a condensation effect does not occur as the two stimuli are still easily differentiable. In our study, we selected two alibis that were considerably different in strength, which may explain why no condensation effect was observed.

Although Experiment 1 could be regarded as a manipulation check for obtaining a contrast effect in order to proceed with Experiment 2, it is important to note that a contrast effect is not exclusively required to obtain a condensation effect. In the hedonic domain, presenting pleasurable odors beforehand (to create a negative contrast) in not the only way to make test odors smell less good. Simply labeling the test odors as “body odors” also make them smell less good, as well as making

them smell more similar (condensation effect), compared to labeling them as “cheese odors” (Zellner et al., 2014). The authors conclude that condensation is not directly linked to a negative hedonic contrast, but rather happens whenever the hedonic value of the stimuli is reduced in general. Similarly, in Experiment 1, although no contrast effect was observed for alibi 8, a condensation effect did emerge. Is that to say that condensation could happen without negative contrast? Because alibi 8 was not displaced towards the left end of the strength scale in both groups, what we have called a condensation effect can simply be an epiphenomenon arising from the displacement (negative contrast) observed for alibi 11 (see Figure 8).

A further factor that may have led to the lack of a condensation effect in Experiment 2 was the way the questionnaire was designed. Each pair of alibis was presented on a separate page, with the participant having to enter the score for a pair of alibis, click the button bringing them to the next page, and restart the process again with reading two new alibis. This may have led to a mental reset, so to speak, between the reading and rating of each pair of alibis. In Zellner et al.’s (2006) Experiment 2, all six juices were presented on the same tray and assembled in groups of two. This may have implicitly led participants to compare the two diluted juices with the previously tasted full-strength juices and made it more difficult for them to taste the difference between the two diluted juices – leading to a reduction of hedonic preference between them. Had our participants read all six alibis on the same page, rating each pair while still being able to read and compare them to the previous ones, we may have obtained different results. This subtle difference is equivalent to asking participants to compare two pairs of apples before comparing a pair of oranges. If all six fruits are present on the table at once, participants are less likely to note the smaller differences in detail between the two oranges, whereas if each pair of fruit was examined

closely on its own, participants would be more likely to notice the smaller differences between the two oranges. By presenting our two weak alibis on a separate page, we may have involuntarily steered the Experimental group's ratings to be closer to those of the Control group.

Another effect that might have impacted our results is the expert versus novice effect. Rota et al. (2007) examined categorization effect in hedonics when the participants were separated in two groups: experts and novices. As previously discussed, introducing categories to separate the stimuli can greatly vary the contrast, even eliminating it completely. Rota et al.'s (2007) study demonstrated that even when the stimuli are not categorized, experts in the field will create subcategories in their judgments whereas novices do not. In their study, they presented attractive orchids, neutral orchids, and irises to plant experts and plant novices. Contrast occurred for both experts and novices when judging the two orchids, but contrast only occurred in the novices when comparing the orchids to the irises. The experts were able to differentiate the two species of flowers and judge them independently of each other – eliminating contrast – whereas the novices categorized them both as "flowers." Our study results might have been affected by this effect in two different yet connected ways. When selecting our participants, we did not vet them in any way in terms of field of study, knowledge on the subject, or familiarity with alibis and crime. This means that some of our participants might have had a certain level of expertise allowing them to better recognize and distinguish the strong and weak alibis, thus lessening or eliminating a possible contrast effect. Secondly, our participants were not primed with any information of what consists of a strong or weak alibi. When judging hedonic stimuli, such as fruit juice, it is evident that there is a difference between the full-strength and diluted juices and the contrast effect arises from individual pleasure regarding the taste. Without prior information about what makes a strong or

weak alibi, our participants may have created their own categories, therefore increasing, or decreasing the contrast effect.

The aspect of expertise in the field is further reinforced as a possible explanation of results in our study when looking at the results of our pilot testing. When the alibis were piloted, some participants kept their ratings within a narrow range of 30 or 40 points, while others chose to use nearly the whole 201-point scale. This might indicate that some participants in the pilot study had a better understanding of what made for a strong and weak alibi and were therefore better able to create categories for themselves before judgments were made on the alibis. This may also indicate that the examples provided in the pilot study of the weakest and the strongest alibis imaginable were not properly attended to.

Limitations and Future Studies

One limitation was the absence of instructions to our participants on what makes an alibi strong or weak. In Zellner et al.'s (2006) study, participants were asked to taste juices. This did not involve having to explain to participants what made the taste of the juice better or worse (as the study examined hedonic preference). Our pilot study included an example of the weakest alibi imaginable and an example of the strongest alibi imaginable to serve as points of reference (i.e., anchors) for the participants' judgments. In both Experiment 1 and 2, participants were left on their own to judge whether the alibis were strong or weak. How would our results vary if we were to include anchors (such as in the pilot study) in both Experiments 1 and 2?

The low number of participants also introduced a limitation to the study. We justified the use of only 18 participants per group in an attempt to parallel Zellner et al.'s 2006 study on full strength and diluted fruit juices. However, a power analysis conducted after the study was completed revealed that the ideal sample size would be quite a bit larger. For our average weak (test) alibis to show significance at a 95% power of test, (Control Group = 33.53, Experimental Group = 7.50, SD = 48.27) we would have needed a sample size of 103 participants per group (ClinCalc.com, Kane 2019). In order to recruit that many participants, we would likely not have been able to conduct the study on SONA alone. Likely, we would have had to use websites such as *Prolific*, a website that allows researchers to pay for participants' involvement. This would allow for a more random sampling of participants to be achieved (ex: non-student, varied ages, varied occupation), rather than the convenient sampling used in this study. Using such websites would also allow us to set participants' exclusion criteria such as being (or having an immediate family member be) a member of a police force or correctional/judicial system, for example.

Another limitation to this study, which distinguishes our methodology from that of our reference study (Zellner et al., 2006), is the absence of a second control group, called the Context Control group. This control group followed the same structure as the Experimental group but replaced the four strong context stimuli with four weak context stimuli similar in nature to the two weak (test) stimuli. This third group serves to verify that a contrast or condensation effect in the Experimental group exist solely due to presence of the strong context stimuli, and not to the presence of *any* context stimuli presented beforehand. As Zellner et al. (2006) found a significant contrast effect in their first experiment, the Context Control group was necessary to solidify their findings. However, excluding a Context Control group from our experiments limits our interpretation of the

contrast effect seen in Experiment 1. Otherwise, we cannot firmly conclude that the contrast effect was due to the presence of the strong context alibis. These limitations, however, lead well into future studies.

One aspect of the methodological design that future researchers may want to alter is that of stimulus sampling. In Olson (2002) and Olson and Wells (2004), three alibis were presented for each of category of person and physical evidence. In consulting with Dr. Olson (personal communication, June 30, 2022), this was done in order to avoid participants responding to the narrative of the alibi, and rather having them focus to the overall aspects of them. For example, using one's mother to corroborate the alibi may seem like a motivated familiar person evidence (and therefore weak) for some, while others may consider the use of one's mother to corroborate as the utmost believable person evidence. To mitigate narrative-driven biases, in future studies, it would be advisable to use multiple test stimuli for each category.

To ensure that participants read through each page presented to them on Google Forms, there would be a benefit in including an attention check or comprehension check. For instance, after the participants read the police report, they would be asked a few simple questions about the crime depicted. A similar procedure could be placed after each alibi judgment. A quick attention checking question would serve to verify that the participant read the alibi and did not simply assign a number arbitrarily. As well, a comprehension check such as "which part of the alibi led you to make your judgment?" would consequently help us in knowing if it is the person evidence, the physical evidence, or the lack of either that allowed for the judgment decision.

Although both contrast and condensation effects do seem possible in the cognitive, inferential realm, the mechanisms by which they occur need to be explored much further. This thesis only scratched the surface of the link between inferential judgments and condensation. We used alibis in this study as they were a sure way to induce an inferential judgment on stimuli that were quantifiably different from one another according to the taxonomy proposed by Olson and Wells (2004). Although this taxonomy was used as a base model for our alibis, this study measured the strength of the alibis based on their believability, not exclusively the alibis' believability. By changing to very nature of the judgments made by the participants, asking them to judge alibi believability, for instance, could possibly exploit more thoroughly the assumed continuum of alibis in the taxonomy, and hence potentially lead to clearer contrast and condensation effects. This study would differ if instead of asking participants to judge the alibi's strength, we asked them one of the following questions: How would you judge the following alibi's credibility? Which alibi do you believe would most lead to a guilty verdict? Which of the following alibis would you prefer to have if you were the suspect in question? This last one would add a kind of hedonic layer of judgment beyond the cognitive inference and would be interesting to compare with Zellner et al.'s (2006) results. Further on this point, the nature of the crime could be changed as well to evaluate if the judgments of suspects' alibis change with it. Does the alibi believability differ if the crime in question is a mass murder? A petty shoplifting? A race-based or gender-based hate crime? These are aspects of the study that can be altered to assess the change in alibi believability.

In a similar study on sensory condensation, Parker et al. (2002) noted that the addition of non-test stimuli can alter the resulting amount of shifting in the test stimuli. Both our Experiment 1 and our Experiment 2 involved participants in our Experimental groups reading four strong alibis, whether

it be individually or in pairs, before reading and judging the two test alibis. A change in the number of alibis to be judged before being presented with the two test alibis might have led to a change in the final ratings.

While on the topic of range, it is worth examining the effect of varying the number of stimuli and range of scale on contrast effects. Parducci and Wedell (1986) examined the relation between the number of stimuli and the size of the rating scale used. In their experiment, using less stimuli and a bigger scale eliminated a contrast effect. Their experiment, used to examine the category effect, used five stimuli on a 100-point scale. A by-product of their results noted the elimination of a contrast effect the wider the range and the lesser the number of stimuli. However, Zellner et al.'s (2006) study used a 201-point scale and 6 stimuli and achieved a clear contrast effect. This may have to do with the type of stimuli used. Parducci and Wedell (1986) used sensory stimuli and responses whereas Zellner et al. (2006) used hedonic stimuli and ratings. In our research, we used the same number of stimuli as did Zellner et al. (2006) and the same 201-point scale. We were only able to achieve a partial contrast effect and a partial condensation effect deriving from this contrast. When examining the possibility of future alibi strength and believability judgments, one might want to consider using a smaller judgment scale. We found that by using a 201-point visual analog scale to test for a contrast effect in Experiment 1 (again to parallel Zellner et al.'s 2006 study), we were left with high-variability data yielding muddied results. Perhaps using a shorter scale such as the 10-point Likert scale used in Experiment 2 would be beneficial to yielding more conclusive results.

To firmly conclude that a condensation effect can occur for inferential judgments without a negative contrast effect would require *no* contrast effect at all. To test this epiphenomenon account

of the condensation effect, we could examine if a condensation effect would emerge from a labeling procedure. By labeling the alibis with stereotypes that society would deem to be honest and dishonest people, perhaps we would achieve different results. For example, would a similar effect be present if our test alibis were labelled to have come from “a nun” vs. “a career criminal,” or from a released suspect vs. a suspect found guilty at court trial? Would social biases such as these act not only to reduce the credibility of the test alibis (under the “career criminal” label), but also to make them more similar (condensation effect), as it the case with the “body odors” label in hedonic judgments (Zellner et al., 2014)?

Zellner et al. (2010) noted that when hedonically weak stimuli precede more neutral stimuli, not only is there a positive contrast effect, but an expansion effect (the opposite of condensation) also occurs between the strong (test) stimuli. This is something that could also be examined in inferential judgments in future studies.

Conclusion

Contrast effects have been greatly studied in the field of sensory and hedonic judgments. Only in the past few decades have researchers started to examine the possibility of a condensation effect in sensory and hedonic judgments as well. In the present study, a mitigated contrast effect was found using alibi strength as inferential judgment stimuli as well as a mitigated condensation effect. However, the latter effect was not found using the traditional methodology and, thus, our interpretation of the results had to vary slightly. Not only was our contrast effect significant for only one of our two weak test alibis, but our condensation effect was measured from the data in our Experiment 1 – an experiment intended to examine a contrast effect. Therefore, we can

conclude that both contrast and condensation possibly can occur in the cognitive inferential realm, but more research must be done to fully understand conditions that would lead to clearer effects.

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Appendices

Appendix A: 36 alibis used in pilot study. From Olson (2002)

(none) = no physical evidence
(easy) = easy to fabricate physical evidence
(diff) = difficult to fabricate physical evidence

Alibis with no person evidence

1. (none) Suspect initially could not remember where he was between 7:30 and 8:30 on the evening in question. Later in the interview he claimed that he had been out for a walk in his neighborhood on the east side of the city. Suspect has no record of gun ownership.
2. (easy) Suspect said that he was eating in a restaurant on the city's north side between 7:30 and 8:30 pm. He claimed to have arrived at approximately 7:30 pm and provided a receipt which was timed 8: 18 pm and was paid in cash. He said he ate alone. Suspect has no record of gun ownership.
3. (diff) Suspect said he had been shopping at the mall on the north side between 7:30 and 8:30 pm on the evening in question. He believed around 8 pm he had been in the jewelry store looking at watches. He said he had been shopping alone and did not buy anything. Security camera video from the store shows the suspect in the store between 8:06 and 8:22. Suspect does not have any record of gun ownership.
4. (none) Suspect said that he was eating in a restaurant on the city's north side between 7:30 and 8:30 pm. He claimed to have arrived at approximately 7:30 pm and stayed for about 45 minutes. He said he ate alone. Suspect has no record of gun ownership.
5. (easy) Suspect said he had been shopping at the mall on the north side between 7:30 and 8:30pm on the evening in question. He believed around 8 pm he had been in the jewelry store looking at watches. He said he had been shopping alone and produced a receipt which was timed 8:18 pm and was paid in cash. Suspect does not have any record of gun ownership.
6. (diff) Suspect initially could not remember where he was between 7:30 and 8:30 on the evening in question. Later in the interview he claimed that he had been out for a walk in his neighborhood on the east side of the city. Security video from an ATM on the route the suspect claimed to have taken showed the suspect walking by at 8:22 pm. Suspect has no record of gun ownership.
7. (none) Suspect said he had been shopping at the mall on the north side between 7:30 and 8:30 pm on the evening in question. He believed around 8 pm he had been in the jewelry store looking at watches. He said he had been shopping alone and did not buy anything. He said he then walked back to his car and drove home, where he spent the remainder of the night by himself. Suspect does not have any record of gun ownership.
8. (easy) Suspect initially could not remember where he was between 7:30 and 8:30 on the evening in question. Later in the interview he claimed that he had been out for a walk in his neighborhood on the east side of the city. He said he stopped at a newspaper stand on his route and produced a cash receipt timed 8: 18 pm. Suspect has no record of gun ownership.
9. (diff) Suspect said that he was eating in a restaurant on the city's north side between 7:30 and 8:30 pm. He claimed to have arrived at approximately 7:30 pm and stayed for about 45 minutes. He said he ate alone. Security video from the restaurant's entrance showed the suspect entering the restaurant at 7:34 pm and leaving at 8:09 pm. Suspect has no record of gun ownership.

Alibis with motivated familiar person evidence

10. (none) Suspect claimed he was at his friend's house all night on the evening in question. He said that he was there from about 4:30 in the afternoon until approximately 9:00 pm. A statement from the friend was taken. The friend believed that the evening in question was the evening A. M. was there. The friend lives in the central city area. Suspect does not own a gun.

11. (easy) Suspect said he was entertaining his brother in his home on the west side of the city on the evening in question. He said they had ordered pizza and provided a pizza delivery receipt, paid in cash, timed 8:07 pm. A statement from the brother was taken; the brother claimed they had been in the home for the entire time between 7:30 and 8:30 pm. Suspect does not own a gun.

12. (diff) Suspect claimed that he was meeting his mother at the airport north of the city on the evening in question. The mother's plane arrived at 7:55 pm. The suspect said that he had met his mother at the gate and accompanied her to the baggage claim. The mother was contacted and confirmed that the suspect met her at the gate and was with her the rest of the evening. Security camera video from the airport shows the suspect going through the metal detectors at 7:32 pm. Suspect does not own a gun.

13. (none) Suspect claimed that he was meeting his mother at the airport north of the city on the evening in question. The suspect said that he had met his mother at the gate at approximately 8 pm and accompanied her to the baggage claim. The mother was contacted and confirmed that the suspect met her at the gate and was with her the rest of the evening. Suspect does not own a gun.

14. (easy) Suspect claimed he was at his friend's house all night on the evening in question. He said that he was there from about 4:30 in the afternoon until approximately 9:00 pm. Suspect also provided a pizza delivery receipt, paid in cash, delivered to the friend's home at 8:07 pm. A statement from the friend was taken. The friend believed that the evening in question was the evening the suspect was there. The friend lives in the central city area. Suspect does not own a gun.

15. (diff) Suspect said he was entertaining his brother on the evening in question. He said that they were shopping at the mall on the west side of the city. A statement from the brother was taken; the brother claimed they had been in the mall for the entire time between 7:30 and 8:30 pm. Security camera video from the mall shows the suspect in the main lobby area at 7:48 pm. Suspect does not own a gun.

16. (none) Suspect said he was entertaining his brother in his home on the west side of the city on the evening in question. He said they had ordered pizza. A statement from the brother was taken; the brother claimed they had been in the home for the entire time between 7:30 and 8:30 pm. Suspect does not own a gun.

17. (easy) Suspect claimed that he was meeting his mother at the airport north of the city on the evening in question. The suspect said that he had met his mother at the gate and accompanied her to the baggage claim. He also provided a receipt for a newspaper timed 8:07 pm and paid in cash. The mother was contacted and confirmed that the suspect met her at the gate and was with her the rest of the evening. Suspect does not own a gun.

18. (diff) Suspect claimed he was at his friend's house all night on the evening in question. He said that he was there from about 4:30 in the afternoon until approximately 9:00 pm. Suspect claimed that at approximately 8:00 pm they went to an ATM machine and a video store. A statement from the friend was taken. The friend believed that the evening in question was the evening A. M. was there. The friend lives in the central city area. Security video from the ATM shows suspect withdrawing money at 8: 12 pm. Suspect does not own a gun.

Alibis with non-motivated stranger person evidence

19. (none) Suspect claimed he was in a taxi, in the city, at 8 pm. He said he got into an argument about the fare with the driver of the taxi and took down the number of the taxi as it was leaving. Suspect believed the driver of the taxi would remember him. The taxi driver was contacted and said that he did remember the suspect in his taxi at approximately 8 pm on the evening in question. Suspect has no history of gun ownership.

20. (easy) Suspect said that he was in a bookstore on the north side of the city between 7:30 and 8:30 pm on the evening in question. He claimed to have been alone, but he purchased several items and produced the receipt timed 8:25 pm and paid in cash. The bookstore clerk was also contacted and, after viewing a photo of the suspect stated that he was in the store that night. She believed he had been there between 7:30 and 8:30 pm. Suspect has no history of gun ownership.

21. (diff) Suspect claimed that he had been at a grocery store in the city between 7:45 and 8:30 pm on the evening in question. He said that he had been grocery shopping, and then stopped at the ATM in the grocery store to withdraw cash. After seeing a picture of the suspect, a cashier at the customer service desk said that she remembered seeing the suspect at the store that night at approximately 8 pm. Camera video from the ATM showed the suspect withdrawing money at 8:26 pm. Suspect has no history of gun ownership.

22. (none)Suspect said that he was in a bookstore on the north side of the city between 7:30 and 8:30 pm on the evening in question. He claimed to have been alone. The bookstore clerk was also contacted and, after viewing a photo of the suspect, stated that he was in the store that night. She believed he had been there between 7:30 and 8:30 pm. Suspect has no history of gun ownership.

23. (easy) Suspect claimed that he had been at a grocery store in the city between 7:45 and 8:30pm on the evening in question. He said that he had been grocery shopping, and provided a receipt, paid in cash, timed 8:07 pm. After seeing a picture of the suspect, a cashier at the customer service desk said that she remembered seeing the suspect at the store that night at approximately 8 pm. Suspect has no history of gun ownership.

24. (diff) Suspect claimed he was in a taxi, in the city, at 8 pm. He said he got into an argument about the fare with the driver of the taxi and took down the number of the taxi as it was leaving. Suspect believed the driver of the taxi would remember him. The taxi driver was contacted and said that he did remember the suspect in his taxi at approximately 8 pm on the evening in question. Security video from the taxi showed the suspect in the taxi between 7:53 and 8:08 pm. Suspect has no history of gun ownership.

25. (none) Suspect claimed that he had been at a grocery store in the city between 7:45 and 8:30pm on the evening in question. He said that he had been grocery shopping, and that he had been alone. After seeing a picture of the suspect, a cashier at the customer service desk said that she remembered seeing the suspect at the store that night at approximately 8 pm. Suspect has no history of gun ownership.

26. (easy) Suspect claimed he was in a taxi, in the city, at 8 pm. He said he got into an argument about the fare with the driver of the taxi. He produced a receipt which was paid in cash and timed 8:07 pm. Suspect believed the driver of the taxi would remember him. The taxi driver was contacted and said that he did remember the suspect in his taxi at approximately 8 pm on the evening in question. Suspect has no history of gun ownership.

27. (diff) Suspect said that he was in a bookstore on the north side of the city between 7:30 and 8:30 pm on the evening in question. He claimed to have been alone. The bookstore clerk was also contacted and, after viewing a photo of the suspect, stated that he was in the store that night. She believed he had been there between 7:30 and 8:30 pm. Security video from the bookstore shows the suspect in the store between 7:34 and 8:21 pm. Suspect has no history of gun ownership.

Alibis with non-motivated familiar person evidence

28. (none) Suspect said he was at a bar on the east side of the city from about 6pm until the bar closed. He claimed his regular waitress served him and described the waitress. He claimed he did not leave the bar all evening. The waitress said that she believed he had been present at the bar all evening, and it was unusual for him to leave his table all evening. Suspect has no history of gun ownership.

29. (easy) Suspect claimed that he left work and went to his regular bar and grill on the west side of the city for the evening on the night in question He claims he had been there between 5:00 pm and 11:30 pm, and produced a receipt for dinner, timed at 8:07 and paid with cash. His regular bartender waited on him. The bartender agreed that the suspect usually visits the bar every week on that same night. He was fairly certain that the suspect had been present in the bar on that evening. Suspect has no history of gun ownership.

30. (diff) Suspect claimed that he had been at a Check-Into-Cash store in the central city between 8:00 and 8:20 pm on the evening in question. He said that he regularly goes to that store to get cash. The teller at the store recognized a picture of the suspect and agreed that he is a regular customer. The teller also indicated that he was there that night Security camera video from the store showed the suspect in the store between 8:03 and 8:18. Suspect has no history of gun ownership.

31. (none) Suspect claimed that he left work and went to his regular bar and grill on the west side of the city for the evening on the night in question He claims he had been there between 5:00 pm and 11:30 pm. His regular bartender waited on him. The bartender agreed that the suspect usually visits the bar every week on that same night. He was fairly certain that the suspect had been present in the bar on that evening. Suspect has no history of gun ownership.

32. (easy) Suspect claimed that he had been at a Check-Into-Cash store in the central city between 8:00 and 8:20 pm on the evening in question. He said that he regularly goes to that store to get cash. The teller at the store recognized a picture of the suspect and agreed that he is a regular customer. The teller also indicated that he was there that night. Suspect provided a receipt for the cash, timed 8:07 pm. Suspect has no history of gun ownership.

33. (diff) Suspect said he was at a bar on the east side of the city from about 6pm until the bar closed. He claimed his regular waitress served him and described the waitress. He claimed he did not leave the bar all evening. The waitress said that she believed he had been present at the bar all evening, and it was unusual for him to leave his table. Security video from the bar's entrance showed the suspect entering the bar at 6: 12 pm and leaving at 12:44 pm. Suspect has no history of gun ownership.

34. (none) Suspect claimed that he had been at a Check-Into-Cash store in the central city between 8:00 and 8:20 pm on the evening in question. He said that he regularly goes to that store to get cash. The teller at the store recognized a picture of the suspect and agreed that he is a regular customer. The teller also indicated that he was there that night Suspect has no history of gun ownership.

35. (easy) Suspect said he was at a bar on the east side of the city from about 6pm until the bar closed. He claimed his regular waitress served him and described the waitress. He claimed he did not leave the bar all evening, and he produced a receipt for a meal timed 8:07 pm. The waitress said that she believed he had been present at the bar all evening, and it was unusual for him to leave his table. Suspect has no history of gun ownership.

36. (diff) Suspect claimed that he left work and went to his regular bar and grill on the west side of the city for the evening on the night in question. He claims he had been there between 5:00 pm and 11:30 pm. His regular bartender waited on him. The bartender agreed that the suspect usually visits the bar every week on that same night. He was fairly certain that the suspect had been present in the bar on that evening. Security camera video from the bar's entrance showed the suspect entering the bar at 5:05 pm and leaving at 11:22 pm. Suspect has no history of gun ownership.

Appendix B: List of alibis in each pilot study in order of presentation

The three pilot study forms each contained one alibi from every taxonomical square (barring the top left and bottom right corners) from Olson and Wells' (2004) taxonomy of believability, presented in a randomly selected order.

Pilot Study Form 1

Alibis: 10 20 28 2 12 11 21 3 29 19

Pilot Study From 2

Alibis: 15 23 6 13 24 31 22 5 32 14

Pilot Study Form 3

Alibis: 16 8 35 17 27 18 9 25 34 26

Appendix C: Laurentian University Research Ethics Board Approval Certificate

APPROVAL FOR CONDUCTING RESEARCH INVOLVING HUMAN SUBJECTS
Research Ethics Board – Laurentian University

This letter confirms that the research project identified below has successfully passed the ethics review by the Laurentian University Research Ethics Board (REB). Your ethics approval date, other milestone dates, and any special conditions for your project are indicated below.

TYPE OF APPROVAL / New X / Modifications to project / Time extension	
Name of Principal Investigator and school/department	Eric Boivin, MA Psychology program, supervisor Luc Rousseau
Title of Project	Judging the relative strength of fictitious crime alibis
REB file number	6020942
Date of original approval of project	April 15th, 2021
Date of approval of project modifications or extension *(if applicable)*	
Final/Interim report due on: *(You may request an extension)*	April 15th, 2022
Conditions placed on project	

During the course of your research, no deviations from, or changes to, the protocol, recruitment or consent forms may be initiated without prior written approval from the REB. If you wish to modify your research project, please refer to the Research Ethics website to complete the appropriate REB form.

All projects must submit a report to REB at least once per year. If involvement with human participants continues for longer than one year (e.g. you have not completed the objectives of the study and have not yet terminated contact with the participants, except for feedback of final results to participants), you must request an extension using the appropriate LU REB form. In all cases, please ensure that your research complies with Tri-Council Policy Statement (TCPS). Also please quote your REB file number on all future correspondence with the REB office.

Congratulations and best wishes in conducting your research.

Rosanna Langer, PHD, Chair, *Laurentian University Research Ethics Board*