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**Seeing Trees and Forests Better: Cognitive Reflection
Increases Sensitivity to Changes in Construal Levels**

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Abstract

Construal level theory suggests that adopting a distal versus proximal psychological perspective changes the way people think and behave. Psychological proximity induces low level, concrete and contextualized mental construals while psychological distance induces high level, abstract and stable construals. Researchers studying construal level effects have recently asked whether the ability to traverse psychological distance is a mental ability. In this paper, we investigate the effect of cognitive reflection on mental construals. Through two studies, the first utilizing an object categorization task with construal levels manipulated through temporal distance, and the second a product preference based task with construal levels manipulated through social distance we establish the moderating effect of cognitive reflection on construal level thinking. Specifically we show that more reflective thinkers have greater sensitivity to changes in construal level than less reflective individuals. We also discuss the possible implications and avenues for future research.

Keywords: Construal level, dual-process theory, cognitive reflection, categorization, attribute alignability

1. Introduction

Dual process theories and the construal level theory are two influential models of information processing which have been at the forefront of research in cognition over the last two decades. Dual process theories, developed to explain non normative responses in a number of decision situations, and lapses in reasoning, posit fast uncontrolled and efficient type 1 and slow controlled but resource consuming type 2 processes (See Evans, (2008) for a detailed review of the different dual process accounts in literature). Construal level theory on the other hand tries to account for the effects of psychological distance on judgments, and has concrete and abstract thinking as the central mechanism. These two theories have helped explain findings in moral psychology (Amit & Greene, 2012; Korner & Volk, 2014), behavioural game theory (Calvillo & Burgeno, 2015; Kim, Schnall, Yi, & White, 2013), and consumer behaviour conflicts (Bitterley, Mislavsky, Dai & Milkman, 2014). Although the two theories explain findings in similar domains, research on the interaction between the two theories and combined effects of dual processes and construal level is scant. Many dual process theorists have included a propensity to think abstractly as a characteristic of systematic effortful thinking. For example, the Need for Cognition (NFC) long and short forms include the statement “The notion of thinking abstractly is appealing to me” (Petty, Cacioppo & Kao, 1984). The Rational Experiential Inventory (REI) also includes a measure of abstract thinking “I enjoy thinking in abstract terms” (Epstein, Pacini, Denes-Raj & Heier, 1996). However, this association has been questioned by both opponents (Keren & Schul, 2009) and adherents (Evans, 2008) of dual process theories, who have suggested that type 2 processing could also aid in non abstract domains (Sloman, 2002).

Apart from this, in a recent paper, Liberman & Trope (2014) while discussing construal level theory asked whether traversing psychological distance is a mental ability. Investigations into potential variables that affect such ability would be worthwhile and extend construal level

theory. Drawing on recent studies on the effect of cognitive capacity restriction on construal level effects in the domain of moral judgments (Korner & Volk 2014), we suggest that type 2 processing could be one such variable.

The current piece of research thus has two objectives. First, we investigate whether type 2 processes aid the ability to traverse psychological distance. Second, we empirically test the two competing views regarding the relationship between type 2 processing and a propensity for abstract thinking. We specifically look at the moderation of construal level effects by a dispositional measure of type 2 thinking, namely cognitive reflection test (CRT) (Frederick, 2005) which is a potent predictor of tasks where normative responding requires type 2 thinking (Toplak, West, & Stanovich, 2011). This moderation is established in a general behaviour as well as in a consumer preference construction context, thereby addressing consumer behaviour issues and implications at both theoretical and empirical levels. Through this research we hope to provide interesting new insights about the interactions of dual process thinking and construal level effects as well as contribute to the understanding of variables affecting the ability to traverse psychological distances.

2. Background

2.1. Cognitive Reflection Test

The CRT (Frederick, 2005) is a simple measure of a certain type of ability. The test measures, through three simple and easy to administer questions, the ability to override a pre-potent but incorrect response which leaps to the mind upon being exposed to the question. The three questions comprising the test are as follows

1. A bat and ball cost \$1.10. The bat costs \$1.00 more than the ball. How much does the ball cost? _____cents.

2. If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets? _____minutes
3. In a lake, there is a patch of lily pads. Every day the patch doubles in size. If It takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake? _____days.

The pre-potent responses that leap to the mind for these questions are 10 cents, 100 minutes and 24 days respectively. The correct answers on the other hand are 5 cents ($105 + 5 = 110$ cents), 5 minutes and 47 days. Researchers utilizing the test have found that the vast majority of wrong answers are the pre-potent ones mentioned above (Frederick, 2005; Liberali, Reyna, Furlan, Stein, & Prado, 2011). Kahneman & Frederick (2005) explained performance on the test to be indicative of attribute substitution carried out by non-deliberative type 1 processes, where an easy to calculate measure substitutes the actual measure given in the problem, hence in the first problem, although the information given is bat - ball = 100, the first answer that appears in the mind does so on the basis of the slightly altered reading of the information as bat = 100, and ball = 10. Liberali, et al., (2011) on the other hand explained errors on the test as arising out of the matching error, for instance in the second question the first part of the question, 5 machines 5 widgets 5 minutes, is matched with 100 machines 100 widgets 100 minutes. However, both views agree that the wrong answer that leaps to the mind appears automatically on the basis of non-deliberative type 1 processes, immediately after the individual reads the question.

2.2. CRT and Performance on Tasks based on type 2 Processing

High performance on the CRT has been shown to explain increased performance on tasks requiring type 2 processing. Frederick (2005) reported more patience among the high CRT group when it came to temporal preferences. He also reported a reduced reflection effect due to a change in the valence of a gamble among individuals scoring high on the CRT.

Oechssler, Roeder & Schmitz (2009) found that the individuals scoring higher on the CRT showed lower susceptibility to the conjunction fallacy (Tversky & Kahneman, 1983) and showed significantly lower conservatism in updating probabilities. Toplak et al (2011) in the most extensive test of tasks involving type 2 processing showed that performance on rational thinking tasks comprising 15 heuristics and biases tasks and 2 syllogistic reasoning tasks showed the highest correlation with performance on the CRT (.49). They also showed that CRT was the strongest unique predictor of performance on the type 2 processing tasks, including non-quantitative tasks. Koehler & James (2009) in a study of strategy employed to choose between outcomes with different probabilities of occurrence, reported high correlation between the performance on CRT and the tendency to choose a maximising strategy, which requires type 2 processing. High performance on the CRT has also been shown to enhance performance on tasks involving Bayesian reasoning (Lesage, Navarrete, & De Neys, 2013; Sirota, Juanchich & Haggmayer, 2014). Hence across domains, research has shown that performance on CRT enhances performance across both mathematical and non-mathematical tasks requiring type 2 processing. This makes CRT a particularly strong dispositional measure of type 2 processing.

2.3. Construal Level Theory of Concrete and Abstract Thinking

Trope & Colleagues have proposed the construal level theory with abstract and concrete thinking as the central mechanism for traversing psychological distance (Liberian & Trope, 2014; Trope & Liberman, 2010). According to construal level theory (Trope, & Liberman, 2010), events that are psychologically distant (in terms of time, or space, or may be happening to a person socially distant from self, or events that are improbable), are represented more abstractly than events that are psychologically proximal. An abstract or high construal makes the individual focus on the central and relatively unchanging aspects of

an event or an object, whereas a more concrete or low construal makes people focus on situational details of the event or object.

The way abstraction changes the meanings of objects is that the same concrete actions may have many abstract representations. For example the concrete action waving the hand may be construed as threatening or friendly depending on who it comes from (Liberman, Sagristano, & Trope, 2002). According to the authors, moving from a concrete to an abstract representation implies choosing from the various representations available. This in turn involves removing the less important non central features and retaining the important central features.

Trope & Liberman (2010) however note that the abstract or higher construals are not simply more impoverished or vague. Although abstraction resulting from increase in psychological distance does result in a loss of specificity, it also involves the generation or selection of a new meaning which is deduced from existing knowledge structures. Therefore, abstract construals of an object or action are only detail poor, rather than information poor representations.

Trope and colleagues in research work spanning more than a decade and a half have identified various psychological dimensions, distance along which leads to abstract representations. Trope & Liberman (2003), in an earlier version of the construal level theory described the effects of changing temporal distance from the present moment on construal levels. They noted that across studies, increasing temporal distance put people in high construal with their focus on abstract representations, and invariant central characteristics of the focal objects. Similarly, social distance from the individual has also been found to lead to an abstract construal (Liviatan, Trope & Liberman, 2009; Stephan, Liberman & Trope, 2010).

Spatial distance (Williams & Bargh, 2008), and hypotheticality or unlikeliness of events (Wakslak & Trope, 2009) were also found to lead to high construal.

Research on combinations of different psychological distance dimensions has also shown the distances to be interlinked, with participants primed on a particular dimension responding more quickly to words denoting similar or congruent distance on a different dimension (far with others, vs near with self etc...) in implicit association tests and stroop tasks (Bar-Anan, Liberman & Trope 2006; Bar-Anan, Liberman, Trope & Algom, 2007). This has led construal level theorists to suggest that the different psychological distance dimensions of spatial, temporal, social and hypotheticality distance have common meanings (Trope & Liberman, 2010).

2.4 Effects of Construal Changes

Changes in construal level have been found to have various effects through different mechanisms. We discuss below a few such effects, and the mechanisms producing the effects. Although researchers across numerous fields have investigated the effects of changes in construal levels, we restrict the discussion to the effects that are directly relevant to the current research.

Categorization: High construal leads people to focus on invariant features of objects. Following the view of Rosch, Mervis, Gray, Johnson, & Boyes-Braem, (1976), that abstract categories are more inclusive and broader, research has found that abstract construal leads individuals to categorize different objects under broader categories. Liberman et al., (2002) studying the effect of temporal distance on the categorization of objects found that individuals categorized objects in fewer wider categories when the focal event was temporally distant. In their study, Liberman et al provided subjects with sets of objects which were relevant for different focal tasks like going on a camping trip, moving out or yard sale.

These tasks were supposed to happen either the next day (temporally proximal condition) or a year later (temporally distant condition). They found that the number of categories used to categorize the objects reduced in the temporally distant condition. Wakslak, Trope, Liberman, & Alony (2006) also found similar effects of broad categorization for unlikely events as compared to more likely ones. Fujita, Henderson, Eng, Trope, & Liberman (2006) also found similar results in studies of segmentation of on-going events when they manipulated spatial distance. In a consumer setting, Lee and Ariely (2006) found that participants sorted shopping items into broader categories when they were in high construal.

Alignable and Non Alignable Comparisons: In an exceptionally influential work regarding similarity judgments by people, Tversky (1977) posited that different weights are assigned to commonalities and differences while making similarity judgements between two objects. Later, developing this idea further, the Structure Mapping theory of similarity (Gentner and Markman, 1994, 1997; Markman and Medin, 1995) further classified attributes into three types : Commonalities (identical attribute levels across alternatives), Alignable differences (common attributes with different levels across alternatives), and non alignable differences (aspects that are not present in one of the alternatives).

Research has demonstrated that people assign greater weight to alignable differences while comparing alternatives. This happens because firstly commonalities do not help in discriminating between alternatives and secondly non alignable differences are difficult to process and require far greater processing effort. They require extra processing effort because comparing them is difficult, and the amount of information for making trade-offs is less (Zhang and Fitzsimmons, 1999), and because they must be evaluated on an absolute scale rather than a relative one. Zhang & Markman, (2001) showed that while choosing between two product options, one of which was superior on alignable attributes while the other was superior on non alignable attributes, individuals gave greater weight to alignable attributes.

This resulted in greater preference for the option superior on alignable attributes over the option superior on non alignable attributes.

Malkoc, Zauberan and Ulu (2005), motivated by temporal construal theory (Trope and Liberman 2003), and the findings of Johnson (1984; 89) who showed that people used abstract attributes to compare between relatively less comparable options, studied the effect of construal levels induced by temporal distance on preference of alignable vs non alignable better options. They found that when the consumption was in the distant future, and subjects were in high construal, subjects adopted abstract thinking and gave greater weightage to non alignable attributes in deciding preference. This resulted in preference for the non alignable better option increasing in the distant future (high construal) condition. When the consumption was in the near future and subjects in low construal, subjects adopted concrete thinking and gave greater weightage to alignable attributes. This resulted in preference increase for the alignable better option in the near future (low construal) condition.

Hence abstract thinking primed by greater psychological distance (in this case temporal distance of the consumption) improved comparability across non alignable attributes of the product options and increased preference for the non-aligned better option.

2.5 Cognitive Reflection and Construal Level Effects

Recent evidence from moral psychology looking at the combined effect of construal level and cognitive capacity on utilitarian vs deontological moral judgments showed that reduced cognitive capacity interacted with concrete and abstract thinking to predict such judgments. The patterns of judgments made under low and high construal reversed with a restriction in cognitive capacity. Therefore reducing type 2 processing through a restriction in cognitive capacity moderated the effect of construal level (Korner & Volk 2014).

On the basis of the pattern of studies outlined above, we propose a moderation of construal level effect by cognitive reflection. We suggest an amplified effect of construal change among more reflective individuals as compared to less reflective individuals. Imagine looking at a tree from a particular distance. On the one hand, the details of the tree are visible more clearly when you walk towards the tree, on the other hand the outline blurs and blends with that of the other trees if you walk away from the tree. The more you walk towards the tree, the better you are able to appreciate the details, the further you walk from the tree, the wider your view and greater the area of the forest you are able to appreciate. The process outlined here is similar to traversing psychological distances and considering details in psychologically proximal objects, and considering abstract qualities in psychologically distal objects.

One can look at the interaction of construal level and type 2 processes as that of a steering wheel and an engine. Construal level is the steering wheel in that it turns the individual towards concrete or abstract thinking, however type 2 processes constitute the engine that powers movement in either direction. We propose that individuals require type 2 processes to traverse psychological distance and individuals who show greater ability for type 2 processing should be able to traverse the distance better than individuals relatively deficient in type 2 processing. Since more reflective individuals are better at type 2 thinking, we expect them to be better at considering specific details as well as decontextualized aspects depending on what they focus on. On the other hand, less reflective individuals are expected not to be as good at considering either specifics or decontextualized aspects when they focus on them.

3. Hypothesis and Overview of Studies

We expect that individuals high in cognitive reflection would be more sensitive to changes in construal level, and as a result the effect of high and low construal would be amplified by

high cognitive reflection. We therefore expect a significant interaction between construal level and cognitive reflection due to the effect being larger albeit in the same direction among more reflective individuals. Since the moderation by cognitive reflection enhances rather than changes the effect of construal level, we also expect to see a main effect of construal level. We do not expect a main effect of cognitive reflection.

Formally stated, the general hypothesis is as below:

H1: Cognitive reflection moderates the effect of changes in construal level.

We conducted two studies to investigate the proposed moderation of the effects of construal level by cognitive reflection. The first study tests the moderation in a study of the effect of temporal distance on broad and narrow categorization. The second study changes the dimension of psychological distance as well as the task characteristics to include a consumer angle, and confirms the moderation in a study of the effect of social distance on consumer preference between two options, each better on either alignable or non alignable attributes.

Hence the study hypotheses are

H1a: Cognitive reflection moderates the effect of construal change on the breadth of categories used to categorize a set of objects.

H1b: Cognitive reflection moderates the effect of construal change on relative weight of aligned and non-aligned attributes in consumer preference.

Study 1 tests hypothesis H1a and study 2 tests hypothesis H1b

4. Study 1: Moderation of Construal Level Effects by Cognitive Reflection in a Categorization Task.

4.1 Motivation for the Study and the Hypotheses

The study investigates the proposed moderation of the effect of change in construal level by cognitive reflection through a task where subjects are asked to provide categories for a list of objects. Subjects, under high construal, were expected to produce broader and hence lesser number of categories, and under low construal, were expected to produce narrower and hence greater number of categories. Since we hypothesised that the effect of construal level would be enhanced in the high CRT group, we expected a significant interaction between cognitive reflection and construal level.

4.2 Method

4.2.1 Participants and Design

115 students (average age = 23.5, females = 34) pursuing their MBA from a Bangalore University participated in the study. The study was conducted in two groups over a term. The students were provided a sum of Rs. 50 for their participation in the study. We manipulated construal level (high vs low) in a between subjects experimental design. The construal level manipulation was temporal, with the low construal condition asking the subjects to provide their responses for the near future (tomorrow) and the high construal condition asking subjects to provide their responses for the distant future (one year from today). The subjects ultimately participated in a 2 (construal level) X 2 (CRT: high vs low) between subjects experiment.

4.2.2 Procedure

CRT measurement: The subjects were asked to answer the cognitive reflection test (First item modified to give price in rupees rather than dollars) as a part of a class exercise in a marketing class. The measurement was taken one day before the categorization study, to avoid any effect of answering CRT questions on the study results.

Categorization task: The students were provided a booklet containing a set of tasks to perform, one of which was the focal task. The subjects were asked to categorize a set of 38 objects into as many categories as they saw fit. The objects provided to them for categorizing were:

brush, tent, matches, camera, soap, gloves, swimming suit, shovel, cricket bat, hat, ball, shirts, sweater, sneakers, coat, music player, carry bag, boots, chocolates, socks, blanket, flashlight, pants, sunglasses, knife, shoes, cigarettes, rope, samosas, canteen, toothbrush, underwear, cold drinks, sleeping bag, pillow, mosquito repellent cream, potato chips, and ax.

Some items in the original study (Lieberman et al., 2002) like hot dogs, dog, snorkel, fishing pole etc... were replaced with Indian counterparts like samosas, carry bag, ball, cricket bat, etc ... Care was taken to ensure that food items in the original study were replaced by food items, recreation or play items were replaced by recreation or play items and so on. The number of items was kept the same as the original study. The subjects were provided a blank sheet of paper after the instructions and were asked to use that for the purpose of forming the categories.

The exact instructions for the task were:

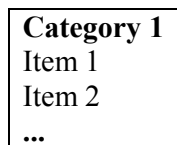
Imagine that you are going on an official camping trip **tomorrow/one year from today** with your friends,

Please write the date of the camping trip _____(DD/MM/YY)

You have been given the task of planning this trip. You will be taking the following **38** items on this camping trip.

Imagine the camping trip you will be taking **tomorrow/one year from today**, and place the following items into as many groups or categories as you think may be appropriate. You can place as many items in a category or group as you like.

Classify by writing the items you think belong together in a column and drawing a box around the column to separate it from the other categories (see figure) below.



Please make sure that you include every item even if you would not use it in reality. Additionally, please do not overlap, that is, please make sure that you put each object in only one category.

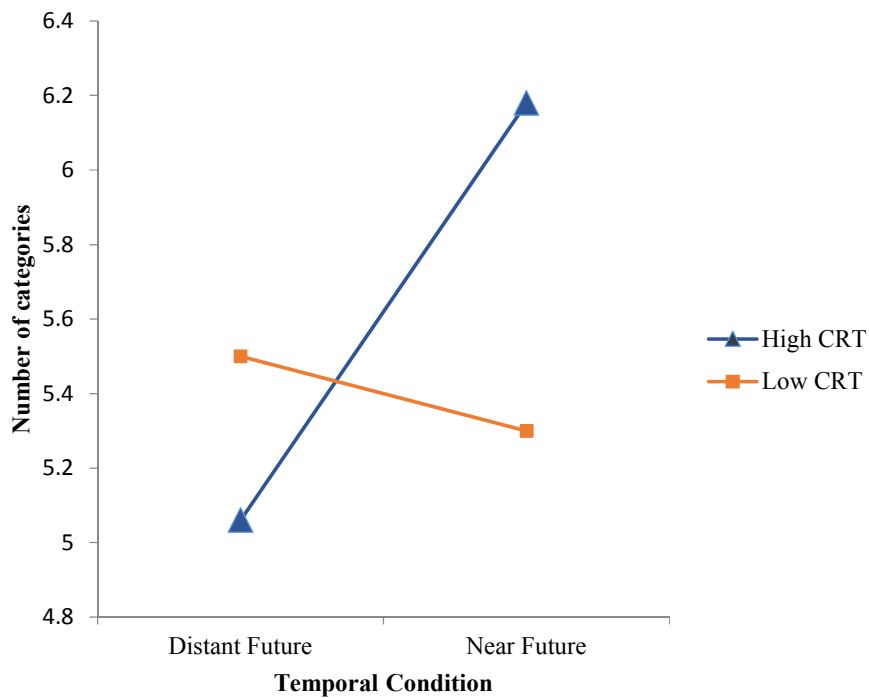
The subjects after completing the task, went on to complete the other tasks in the booklet. The study was conducted by assistants who were blind to the hypotheses in the study. The subjects were asked if they had understood the purpose of the studies they had participated in, none of them expressed an understanding of the purpose of the studies.

4.3 Results and Discussion

CRT performance: The mean CRT score was 1.47 (S.D. 1.08). 24.3% of the individuals were unable to successfully answer any of the questions, 26.1% correctly answered one question, 27.8% correctly answered two questions, and 21.7% correctly answered all the three questions. There was no significant difference between males (Mean = 1.47, S.D. = 1.11) and females (Mean = 1.45, S.D. = 1.03), $t = .094$, $p > .9$. Following Oechsler et al., (2009), we decided to classify those who had correctly answered no more than 1 question correctly as the low CRT group and those who had correctly answered more than 1 questions correctly as the high CRT group.

Categorization: To analyse the effects of construal level and cognitive reflection on categorization, we ran a 2 (construal level high vs low) X 2 (CRT high vs low) ANOVA, with the number of categories as the dependent variable. The results (See figure 1) showed no main effect of CRT, high CRT = 5.61, low CRT = 5.41 ($F = .444$, $p > .5$), and no main effect of construal level, high construal = 5.29, low construal = 5.75 ($F = 1.93$, $p = .16$), although the results were in the predicted direction. The predicted interaction of construal level and CRT level was marginally significant ($F = 3.89$, $p = .05$, partial $\eta^2 = .034$). Independent samples T tests showed that in the low CRT group, the number of categories used to categorize the objects was not significantly different in the high (Mean = 5.50, S.D. = 1.52) and low (Mean = 5.30, S.D. = 2.01) construal conditions $t = .414$ $p > .6$. On the other hand, the number of categories used by the high CRT group was significantly lower in the high construal (Mean = 5.06, S.D. = 1.53) than in the low construal condition (Mean = 6.18, S.D. = 1.98), $t = 2.36$, $P = .02$.

Figure 1: Mean Number of Categories Used to Classify Objects in Near and Distant Future.



Thus, this experiment provides evidence that more reflective individuals are more sensitive to the change in construal level. The low CRT group did not show change in the number of categories used to categorise the objects due to a change in construal levels. The high CRT group, on the other hand showed a significant reduction in the number of categories used to categorize the objects in the distant future condition as compared to the near future condition, and this resulted in a significant interaction between construal level and cognitive reflection. This experiment provides evidence for a moderation of the effect of construal level by cognitive reflection.

5. Study 2: Moderation of Construal Level Effects by Cognitive Reflection in a Preference Task.

5.1 Motivation for the Study

The first study shows some evidence for the proposed enhanced effect of construal change among the high cognitive reflectors; however it could be argued that the first study merely shows the effect of greater cognitive effort. As Liberman et al., (2002) pointed out, the using a greater number of categories to categorize the objects probably required greater effort (pg 530). It is therefore possible that high cognitive reflectors found the near future condition to be more relevant and therefore applied greater systematic effortful processing in the near future condition as compared to the distant future condition. Hence it could be argued that rather than showing an enhanced effect of construal change, the study merely shows greater type 2 processing by more reflective individuals.

Apart from this, the effect seen in the first study was marginally significant, and thus a second study was felt necessary to replicate the result. For the second study, we chose an alignable attribute based product preference task, where the subjects were required to give relative preferences for two equally attractive product options, one of which was superior on alignable attributes while the other was superior on non alignable attributes. We chose this task for two reasons. First, in this study, the expected effect of construal and effortful processing is opposite to that expected in the first study. In the first study, according to the views of Liberman et al., (2002), more effortful processing should produce greater differentiation and narrower categories which are more in number. Therefore the effect of more effortful processing is the same as that expected in the low construal condition. In the aligned vs non-aligned task, more effortful processing leads to a higher preference for the non-aligned better option (Zhang & Markman, 2001), this is the same as the effect seen in the high construal condition. Moreover, if the effect is merely greater processing by the more

reflective individuals, we should see a main effect of cognitive reflection on product preference along with the main effect of construal level, and the preference for the non-aligned option in the high CRT group should be higher than that in the low CRT group in both low and high construal conditions.

On the other hand, if greater cognitive reflection leads to enhanced construal level effects, then we should not see a main effect of cognitive reflection. Rather, we can expect to see an interaction of cognitive reflection and construal level, produced due to the effects of construal level on preference of alignable/ non alignable option being amplified among the high CRT group.

Second, choosing this task for the study allowed us to check the enhanced effect of construal level among more reflective individuals in a consumer behaviour setting.

We also wanted to investigate the effect of deciding for self vs other on the preference for aligned vs non-aligned better option. We expected the effect of this particular manipulation to be the same as that seen for temporally proximal and distal conditions (Malkoc et al., 2005). Pronin, Olivola & Kennedy (2008) showed that the decisions people take for their future selves are similar to the decisions they take for others and hence we expected the effect of deciding for others to be the same as deciding for the future, and expected the preference for the non-aligned better option to be higher when subjects are deciding for others than when they are deciding for themselves.. We also anticipated a significant construal level by cognitive reflection interaction due to the effect being much greater among more reflective individuals.

5.2 Stimulus Preparation

The stimulus shown to the subjects were prepared following the procedure laid out in Zhang & Markman (2001). We created two options, one of which was superior on alignable attributes and the other which was superior on non alignable attributes, through two pre-tests amongst the same student population as that used for the main study.

Pre-test 1: Prior to conducting the main study, we conducted a pre-test using options for four product categories (Popcorn, Potato chips, Hotels and Vacation destinations – See Appendix 1 for the attributes used in the pre-test) to make sure that the options used in the main study were equally preferable at an overall level. We gathered attractiveness ratings (22 subjects) on a 9 point scale with very unattractive (-4) and very attractive (+4) as the end points, for a set of attributes for each of the product categories. We also gathered importance ratings (21 subjects) on a 9 point scale with not at all important (1) and very important (9) as the end points, for the same attributes.

We selected the common, alignable, and non alignable attributes that constituted the products that were used for the main study on the basis of the attractiveness and importance ratings. We selected combinations of attributes, which would make one option clearly better on alignable attributes, and the other option clearly better on non-alignable attributes, while keeping the options similar in terms of average overall attractiveness and importance of attributes. We decided to use Popcorn in the final study, since the product was common to two important earlier papers which formed the basis of the current study (Malkoc et al., 2005; Zhang & Markman, 2001) The subsequent analysis was carried out for all four product categories, however is being provided here only for the popcorn options.

When all the attributes were considered, i.e. the common, alignable and non alignable attributes were considered together, the alignable better option (brand P) and the non

alignable better option (brand Q) of popcorn used for the study (See table 1) were not significantly different on average attribute attractiveness (mean = 1.60 and 1.55, paired sample $t = .316$ and $p >.7$) and average attribute importance (mean = 5.86, and 5.73, paired sample $t = .816$, $p >.3$).

The alignable attributes in the aligned better brand (Brand P) were rated significantly higher than the corresponding attributes in the non-aligned better brand (Brand Q) on both attractiveness (mean = 1.90, and 1.03, paired samples $t = 2.09$, $p = .05$), and importance (means = 6.09 and 4.39, paired samples $t = 3.77$, $p = .001$).

The non alignable attributes in the non-aligned better brand (Brand Q) were rated significantly higher than the corresponding attributes in the aligned better brand (Brand P) on both attractiveness (mean = 0.81 and 1.51, paired samples $t = 2.76$, $p = .01$), and importance (mean = 4.90 and 6.23, paired samples $t = 3.62$, $p = .002$).

Pre-test 2: The alignable and non - alignable options thus created (See Table 1) were then used for second pre-test, An independent set of subjects (N=92) belonging to the same course in the same university as the participants in the main product preference study were asked to rate the overall attractiveness of each option presented to them. Half of the participants rated the aligned better option while the other half rated the non-aligned better option on overall attractiveness using a nine point attractiveness scale anchored on very unattractive (-4) and very attractive (+4). The Non-aligned better option was rated slightly better (Mean = 2.15, S.D. = 1.34) than the aligned better brand of popcorn (Mean= 1.78, S.D. = 1.29), however the difference was not significant, $t = 1.33$, $p >.1$.

Table 1: Aligned Better (Brand P) and Non-Aligned Better (Brand Q) Options of Popcorn

Brand P	Brand Q
Common Attributes	
Low cost per serving	Low cost per serving
Low level of sodium	Low level of sodium
Not Salty	Not Salty
Easy to prepare	Easy to prepare
Aligned Attributes	
Large size kernels	Medium size kernels
Pops in its own bag	Requires a microwave bowl to pop
Calories equal to a slice of bread	Calories equal to a tablespoon of sugar
Crunchiness lasts long	Crunchiness lasts 3 hours
Non-Aligned Attributes	
Slightly Low in corn and grain flavour	Does not stick in teeth
Tastes a bit sweet	Not likely to burn
Has some citric acid	Almost no kernels left unpopped
With waterproof wrapping	Instructions easy to follow

5.3 Method: Main Study

5.3.1 Participants and Design:

111 students (average age = 23, females = 29) pursuing their MBA from a Bangalore University participated in the study. The study was conducted in two groups over a week. The students were provided course credit for their participation in the study. We manipulated construal level (high vs low) in a between subjects experimental design.

5.3.2 Procedure:

The participants were provided a booklet with detailed instructions about the task they were supposed to complete. In the booklet, the participants were shown attribute descriptions of the aligned better and the non-aligned better brands. The positions of the aligned better and non-aligned better brands were counterbalanced between participants.

The participants were asked to imagine that they were on the way to a grocery store to buy popcorn. As social distance was being used to manipulate construal level, in the low construal condition, they were asked to imagine that they were buying microwave popcorn for their own consumption. In the high construal condition, they were asked to imagine that they were purchasing the popcorn for an acquaintance for his/her consumption. Subsequently both groups were given the following instructions.

You have to allocate 100 points across brand P and brand Q in proportion of your preference for the two brands of popcorn.

For instance if your preference is much higher for brand P than brand Q, please allocate higher points to brand P, On the other hand if your preference is higher for brand Q, then allocate higher points to brand Q. (for example 70 points to the more preferred brand of

popcorn and 30 points to the less preferred brand of popcorn) The higher the preference for an option, the higher the points allocated to it.

If you prefer both the options equally, or you believe that both options are equally good then you can provide 50 points to each.

Once they had provided their relative preference by allocating points out of 100, they were asked to describe their decision process in reaching the above preference. The participants were encouraged to describe the steps taken, and the specific attributes considered in reaching the preference.

Subsequent to their description of the process, the participants then attempted the Cognitive Reflection Test (CRT) with the first item modified for Indian participants. Finally the participants described their current feelings and emotions using the PANAS (Watson, Clark and Tellegen, 1988).

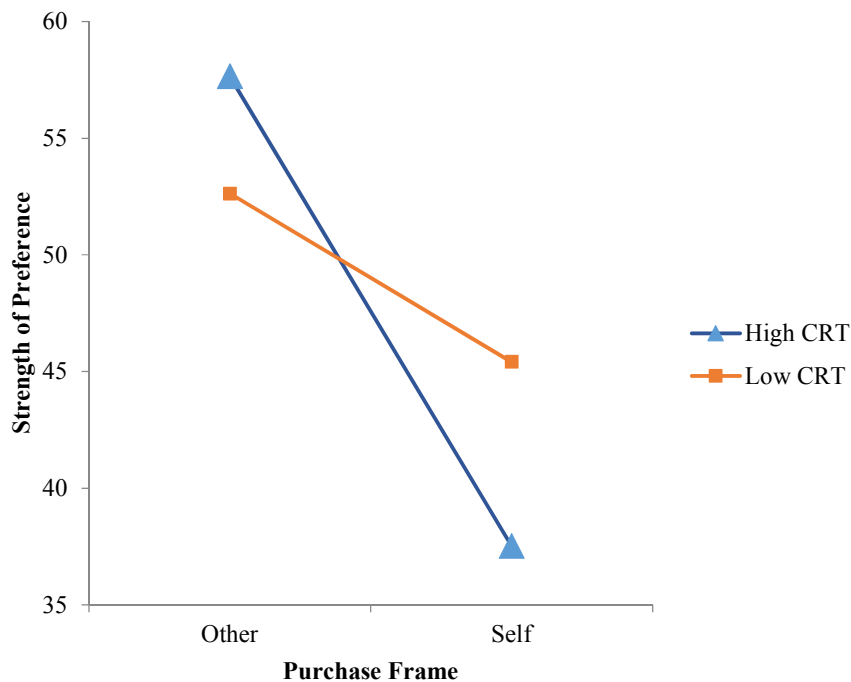
5.4 Results and Discussion

CRT performance: The mean CRT score was 1.25. 27% of the subjects were unable to correctly answer any of the questions. 36% correctly answered 1 question, 21.6% correctly answered two questions and 15.3% correctly answered all three questions correctly. Similar to the first study, we did not see a significant difference between the CRT scores for males (Mean = 1.32, S.D. = 1.04) and females (Mean = 1.03, S.D. = .94), $t = 1.34$, $p > .1$. Similar to the first study, we classified those correctly answering no more than one question as the low CRT group and those correctly answering two or three questions correctly as the high CRT group.

Preference: We ran a 2 (construal level high vs low) X 2 (CRT high vs low) ANOVA with preference for the non-aligned better option as the dependent variable. we saw the expected

main effect of construal level, $F(1, 107) = 18.35, P < .001$, partial $\eta^2 = .146$. There was no significant main effect of CRT, $F(1, 107) = .208, P > .2$. As expected, there was a significant interaction between construal level and CRT, $F(1, 107) = 4.11, P < .05$, partial $\eta^2 = .037$ (See figure 2).

Figure 2: Mean Strength of Preference Allocated to the Non-Alignable Better Brand in Study 2.



We found through independent samples T tests that participants in the other purchase (high construal) condition showed significantly higher preference for the non - aligned better option than the participants in the self-purchase (low construal) condition (mean preference = 54.42 (SD = 16.45) vs 42.41 (SD = 15.13), $t(109) = 3.61, p = .001$). As expected, the participants in the high construal condition relied more heavily on the non - aligned attributes in deciding their preference for the brands than participants in the low construal condition.

We then split the sample by cognitive reflection (high vs low) and ran further independent T tests to assess the effect of construal change. In the high CRT group, the preference for the non-aligned better option was about 20 points higher among those in the high construal condition, and this difference was highly significant (mean = 57.65 (SD = 13.43) vs 37.52 (SD = 16.28), $t(39) = 4.31$, $p < .001$). In the low CRT group, the preference for the non-aligned option improved by about 7 points among the participants purchasing for others (high construal), and this difference was marginally significant (mean preference = 52.63 (SD = 18.02) vs 45.41 (SD = 15.58), $t(68) = 1.78$, $p = .08$).

Attribute mentions: We ran a 2 (Construal level: high vs low) X 2 (CRT score: High vs low) X 2 (Mentions: Aligned better attributes vs Non Aligned better attributes) mixed ANOVA, with mentions as the dependent variable (see table 2 for details), to check the effect of construal level and CRT on attribute mentions. There was an interaction of mentions and condition group ($F(1,107) = 5.581$, $p = .02$, partial $\eta^2 = .037$). There was no other significant main or interaction effect.

We wanted to check whether the construal by mentions interaction was present in both the high and low CRT groups, and so we divided the subjects into high and low CRT groups and ran a 2 (construal level: high vs low) X 2 (Mentions: Aligned vs non aligned attributes) repeated measures ANOVA. We saw no significant interaction of construal level and mentions in the low CRT group, $F(1,68) = .487$, $p > .4$. However, we saw a significant interaction of construal level and mentions in the high CRT group, $F(1, 39) = 8.258$, $p = .007$. Paired sample t tests showed significantly higher mentions of aligned attributes in the low construal condition for the high CRT group but not for the low CRT group. Both high and low CRT groups did not show significant difference between mentions of aligned and non-aligned attributes in the high construal condition. We also checked for mood effects and did

not find any difference in positive and negative affect across conditions, and across high and low CRT groups.

Table 2: Mentions of Aligned and Non-Aligned Attributes

Mentions	All Subjects		High CRT		Low CRT	
	High Construal	Low Construal	High Construal	Low Construal	High Construal	Low Construal
AA	1.57	2.08	1.35	2.19	1.69	1.91
NAA	1.76	1.58	1.90	1.52	1.69	1.61
P values	.41	.03	.14	.009	1.0	.31

Note: AA = Aligned Attributes; NAA = Non Aligned Attributes

The results of the experiment provide further support to our hypothesis of the effect of construal change being enhanced among the more reflective individuals, and the effect being greater than that seen among the less reflective individuals. We saw that while construal change led to the expected effect preference increase for non-aligned better option in case of high construal, there was a significant interaction effect of cognitive reflection and construal level, This interaction was in turn due to the change in preference being much greater among the more reflective individuals.

One could argue that perhaps taking decisions about others led the more reflective individuals to think more systematically and put greater effort in the high construal condition, while putting lesser effort in the low construal (purchase for self) condition. Hence, instead of the

high CRT group being more sensitive to construal changes, and as a result focussing more on the aligned attributes in the low construal condition and on non-aligned attributes in the high construal condition, the effect is produced by the difference in the cognitive effort put in the self vs the others condition, However, we would argue against this alternative explanation for two reasons.. First, such an explanation would be plausible only if deciding for self somehow reduced the involvement and effort in the decision only for the more reflective individuals, since if the involvement and effort were reduced in general due to the subjects purchasing for self rather than others, we should have seen this reduction in effort for both high and low CRT groups, which should have resulted in a main effect of cognitive reflection. Second, an effect of change in construal level should produce a construal level X attribute mentions interaction, with aligned attributes being mentioned more in low construal and non- aligned attributes mentioned more in high construal. This interaction is seen only in the high CRT group, and not in the low CRT group

6. General Discussion and Future Research Directions

Two studies investigated the relationship between cognitive reflection and abstract thinking. The studies investigated the effect of cognitive reflection when individuals were put in high and low construal. Both studies showed enhanced effect of the change in construal level among individuals scoring high on the CRT, showing therefore that more reflective individuals are more sensitive to the effects of construal change as compared to less reflective individuals. The present research also shows that more reflective individuals are better at traversing psychological distance. Liberman & Trope (2014) have noted that abstraction is required for traversing distance and since abstraction in turn may be aided by cognitive reflection, this is plausible. The interesting part is the increased focus on details when in low construal for the high CRT group.

The present research opens interesting new avenues for research. The relationship between cognitive reflection and construal level means that the existing effects of construal level may change depending on cognitive reflection. For instance, if increased psychological distance from a purchase changes the focus from feasibility to desirability concerns (Trope & Liberman 2000; 2003), this effect may be more enhanced among more reflective individuals. This could also mean that more reflective individuals may select highly desirable future goals, and may experience greater dissonance, as the goals become temporally proximal and feasibility concerns become more important. Psychological distance also changes the focus on pros and cons of an action (Eyal, Liberman, Trope, & Walther, 2004) and more reflective individuals may show higher focus on the pros of an action in the distant future and increased focus on the cons of an action in the near future. Smith & Trope (2006) also showed that an elevation in power led people to focus on abstract information. In case of settings of changing power in organizations, more reflective individuals may be able to better make the transition to positions of higher power by being better at changing their focus from mechanistic details to patterns and structure, and being better at extracting the gist from situations. These can be investigated in the future.

The research also provides interesting insights into context based preference construction. The second study showed greater shift in preferences among more reflective individuals who were better at type 2 thinking. Hence greater type 2 thinking amplified context effects due to a shift in focus over the attribute space. It would be interesting to see if other context effects would also be moderated by cognitive reflection. In a recent article, Dhar & Gorlan (2013) distinguished between context effects that occur due to type 1 processes and effects that occur due to type 2 processes. It would be interesting to study if high CRT scores leads to preference shifts in the latter but not the former. Although the present research studies only context effects, future studies could also include investigations of other choice effects such as

task related and framing effects. Moderation of such effects by CRT could be a fruitful avenue of research.

We believe that the studies also contribute to the discussion on the relationship between type 2 processing and abstract processing. Contrary to system views that look at all type 2 processing as abstract, we see that increased processing aids consideration of abstract features when focal objects are psychologically distant and aids the consideration of concrete features when focal objects are psychologically proximal. The evidence provided in present research provides empirical support to the increasingly favoured non system view of type 1 and 2 processes which notes that while the other characteristics may be typical, they may not be central for type 2 processing (Evans, 2008; Stanovich & Evans, 2013).

We believe that the present research also poses some interesting questions on the centrality of decoupling in type 2 processes as claimed by Stanovich (2009; 2012). Decoupling is a process by which the individual disengages from the present reality in order to consider future consequences, counterfactuals and hypothetical situations. This process is therefore likely to be similar to the process of traversing temporal, spatial and hypothetical distances. Findings of the present research suggest that greater utilization of type 2 processes does not necessitate decoupling. It is possible that decoupling itself may require cognitive capacity and reflection, however reflection can also occur on factual present reality, and type 2 processes may be engaged without there being any decoupling. If our contention is true, it would mean that while decoupling may require type 2 processes, type 2 processes may not necessarily require it, thus rather than decoupling being a central feature of type 2 processing, the relationship is the reverse, with type 2 processing and cognitive capacity and effort being central requirements for decoupling. Further research on the role of cognitive effort and capacity on decoupling should help clarify these questions.

It is likely that the cognitive requirements of the task may also play a part in the relationship between cognitive reflection and abstract and concrete thinking. Therefore the interaction between cognitive reflection and construal level may be higher in case of tasks requiring more cognitive resources. Thus the effect seen in the present research may not be apply to some other tasks that require less cognitive resources.

A limitation of the research is the utilization of only two out of the four distance dimensions for the purpose of investigating the relationship between cognitive reflection and concrete and abstract thinking. It is possible that the effects are enhanced or reduced due to the different dimensions depending on how core or central is the particular psychological distance dimension.

In conclusion, the present findings contribute to our understanding of the relationship between cognitive reflection and abstract and concrete thinking, by integrating dual process accounts of judgment and decision making and Construal Level Theory. The findings also contribute to consumer preference literature by showing how such interactions influence preference construction. We hope that this research will lead to further investigation into this interesting area of inquiry.

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Appendix

Product Attributes used in the Pretest

Hotel
Newly furnished building
Close to a lake
Fully stocked gym
Clean fresh smelling rooms
DVD player in room
LCD TV with DTH in room
Attention check please mark 9
In a crowded business district
Hotel outdoors not clean
Refurbishing done 5 years ago
Spa facilities
Taxi/car rental on call
Themed stylish interiors
Attention check mark 0

Free wifi facility
Air conditioned room
Spacious bathrooms
Breakfast spread with multiple options
Staff known for their politeness
Average food
Roof top Swimming pool with a view
Attention check please mark 4
Standard interiors
Swimming pool
Centrally located
Slightly cramped bathrooms
Limited breakfast spread
Windows with noise reduction
No 24 hour coffee shop

Popcorn
Crunchiness lasts long
Almost no kernels left unpopped
Easy to prepare
Low sodium
Low fat
Kind of crispy
Attention check please mark 9
Slightly low in corn and grain flavour
Has some citric acid
Crunchiness lasts 3 hours
True corn flavour
Sticks a bit in the teeth
Large size kernels
Attention check mark 0
With waterproof wrapping
Not Salty

Calories equal to a slice of bread
Pops in own bag
Not likely to burn
Tastes a bit sweet
Not tough
Attention check please mark 4
Medium size kernels
Instructions easy to follow
Low cost per serving
Calories equal to a table spoon of sugar
Requires a bowl to pop
Contains no chemicals
Evenly coated
Does not stick in teeth

Beach Vacation
Highly predictable weather
High Waterfalls
Multiple beaches for tourists
Slight lack of public conveniences
Whale watching
Nightlife slightly restricted
5 kinds of water sports
Attention check please mark 9
Intimate beaches
Weather slightly unpredictable
3 kinds of water sports
Friendly locals
Two beaches for tourists
Very good night life
Attention check mark 0
White sand beaches
Island safari

Limited cultural tourism
Congested city beaches
Clear blue waters
Food shacks present on the beach
Medieval history spots
Attention check please mark 4
Far from place of residence
Good road connectivity
Close to place of residence
Average food options
Chance to experience tribal living
Coconut trees and palm fronds

Potato Chips
9 grams of fat
Palette feels oily
Original potato taste
National brand
Ridged for extra taste
Even sized chips
Calories equal to 8 slices of bread
Attention check please mark 9
Tongue feels oily
Calories equal to 6 slices of bread
Somewhat sweet
Oily appearance
Low cost per serving
No broken chips
Attention check mark 0
Local brand
Slightly thick

Quite salty
Somewhat tender
Has an aftertaste
Strong taste
Unevenly coated
Attention check please mark 4
Crunchy
Even coated
Package size lunch box
6 grams of fat
Not too salty
Cracker like
Distinct potato flavour
Very thin