Numerosity and Cognitive Complexity of a Medium as Moderators of Medium Effect on Effort

by

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Author's declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Abstract

As a part of loyalty programs in marketing or as incentive plans in companies, mediums have attracted considerable interest from marketing and organizational behavior researchers. Previous studies focused mainly on the effects of mediums on people's choices and not on the role of moderators of a medium effect. The goal of the present thesis is to study two such moderators namely the numerosity of a medium and the cognitive complexity of mediums. In this study, after a thorough theoretical analysis, experimental data is analyzed to explore the relation between numerosity and cognitive complexity of a medium on individuals' efforts. Our findings suggest that the medium effect is stronger when a medium is more numerous. Also, a more cognitively complex medium makes the mediums more effective.

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Dedicated to my loving parents,

In appreciation of their endless love, care and support in every single moment of my life

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1. Introduction

Recently, Hsee, Yu, Zhang, and Zhang (2003) named a point given to customers within loyalty programs, or a token/voucher awarded to employees within incentive programs in companies as medium. Hence, a medium is used as mediator between effort and reward. A person is first rewarded by a medium once she puts an effort in a task, then the medium can be redeemed for a desired reward later on. Applications of mediums have been increased abundantly. Mediums have been used to reward employees' achievements in organizations and to keep customers through loyalty programs in marketing.

In organizations, employees receive a reward for reaching a specific level of performance. For instance a successful example of using mediums in companies to reward employees' achievements is the GoalQuest® program, designed by the company called BI[1]. The GoalQuest® is an incentive program using points as mediums. In this program, employees are rewarded some points once they accomplish a task successfully. They can redeem their accumulated points to a desired reward later. Likewise, in marketing, customers are rewarded for the amount of money they spend. Usually it is in the form of point cards that customers are identified and allotted points for each purchase which can be redeemed for future discounts or free prizes. The Air Miles[2] is one of the best-known reward programs. Members of the Air Miles can earn points by purchasing flight tickets or any merchandise within the program, and can redeem the accumulated points for a free flight, hotel stays, upgrading a flight class, or even for consumer products.

[1] http://www.biworldwide.com
[2] https://www.airmiles.ca

As medium is largely used in daily life, it has been extensively studied in the marketing and organizational behavior literatures (e.g., Hsee et al. 2003; Meyvis, 2005; Soman & Shi, 2004; Van Osselaer, Alba, & Manchanda, 2004). The studies show how medium affect individuals' choices. Hsee et al. (2003) compared individuals' likelihood of choosing an option over the other one in situations with and without a medium. Their experiments show that mediums can create an illusion of advantage, and consequently lead individuals to make suboptimal choices. This change in preferences caused by mediums is called the "medium effect". In another study, Van Osselaer et al. (2004) examined the effects of different allocation of points on people's choices. Their results showed that people's choice differed when the schedule of points differed while the relation between performance and reward was the same. Individuals were influenced by mediums and they opted for the option with the highest points at the time of choice.

As summarized briefly above, previous studies showed that mediums affect individuals' choices. However, in order to influence customers or employees' behavior better, managers need to know how to make the medium effect stronger. In this study we are interested to see under what conditions the medium effect is stronger. In other words, we want to look at some of the factors that might moderate the medium effect. We propose numerosity and cognitive complexity of a medium as two moderators of the medium effect. We hypothesize that the medium effect would be stronger when a medium is more numerous. Also, we expect that the medium effect be stronger when the relations between effort, medium, and reward is more cognitively complex.

Our results will provide useful information for design of mediums. In order to design a medium properly, it is useful to have a good knowledge of programs where medium is used. As

mediums are largely used in loyalty programs and incentive programs, we will first look at applications of mediums in these contexts. Then we will proceed to the medium effect to discuss relevant literature leading to our thoughts and hypotheses in the current studies. We will then continue with our studies which will be followed by a general discussion.

2. Applications of Mediums

In this section, we discuss some uses of mediums in practice. More specifically, we will review the applications of loyalty programs that are widely used for marketing purposes and as incentive programs in organizations. Having knowledge of different contexts where mediums are used will make our contribution clearer.

2.1. Loyalty Programs

Mediums have been used abundantly in marketing as part of loyalty programs. Loyalty programs (a.k.a. frequency programs) try to make customers loyal to a firm by motivating them for more purchases (Dowling & Uncles, 1997). Loyalty programs prompt customers to buy again by rewarding them when they repeat purchases from the company (Liu, 2007). Some of the well-known customer loyalty programs are point cards and the frequent flyer programs by airlines. Typically, in loyalty programs consumers earn points or miles for each purchase they make. "More than 130 airlines currently have a customer loyalty program and 163 million people throughout the world collect loyalty-based miles" (Berman, 2006, p.124). Loyalty programs are also popular outside of the airlines industry. According to Kivetz and Simonson (2002), "Nearly half of the U.S. population belongs to at least one frequency program and that such programs are growing at a range of approximately 11% a year"(p.155). Due to the large application of loyalty programs and mediums, study is essential.

According to Berman (2006) there are four different types of loyalty programs. In Type 1, customers swipe their membership cards and receive some discounts immediately. This may not be considered a real loyalty program in the sense that all customers benefit the same discount

rate regardless of their purchase history. In fact, Type 1 does not prompt customers to repeat purchases from the offering firm as the discount rate does not depend on their previous spending. Type 2 loyalty programs reward customers a free good/service after they purchase a certain number of goods/services. The reward is usually the same good/service that has been purchased before. An example of Type 2 program would be a coffee shop offering one free coffee after buying 10 coffees. Note that Type 1 and Type 2 programs do not use mediums. However, Type 3 and Type 4 use mediums and they require tracking customers' purchases. In Type 3 loyalty programs customers are rewarded a free good or discounts *based on the number of points* they collect. Airline miles programs are a good example of Type 3 programs. Finally, Type 4 programs require a complicated database and complex communication. Type 4 programs are similar to Type 3 as in both types rewarding is based on using points, but unlike Type 3, Type 4 programs uses individual communication with customers and informs them of promotions and rewards based on their purchase history.

Mediums have been used in different scales and designs. Different allocation of points can be observed among different loyalty programs. For example, Best Buy Reward Zone [3]allots 1 point for each dollar a customer spends. A customer can redeem every 400 points for a $5 reward certificate to be spent in any Best Buy store. So, a member of this reward program should spend at least $400 in order to be rewarded by $5 reward certificate. On the other hand, HBC rewards 50 points for each dollar spent at the Bay, Zellers, or Home Outfitters[4]. HBC members should earn 80,000 points in order to redeem them for a $10 HBC gift card.

[3] https://www.bestbuyrewardzone.ca/progdetails.jspx
[4] http://www.hbc.com/hbcrewards/

This diversity of point scales led us to the research question whether the numerosity of mediums matters. One of our goals in this research, for instance, is to find out which of the above reward programs is more effective: Best Buy Reward Zone which gives 1 point per dollar spent or HBC which rewards customers 50 points per dollar spent. Note that from the normative perspective Best Buy's loyalty program should be more attractive for consumers as they need to spend only $400 in order to receive $5 gift certificate (i.e. 1.25% return on the money spent) at Best Buy, as opposed to spending $800 for a $5 gift certificate (i.e. 0.625% return) at HBC's reward program. However, psychologically consumers might find HBC's reward scheme more attractive than Best Buy's as HBC uses a more numerous medium, and rewards each dollar spent with 50 points. It might be, for instance, that customers might see themselves closer to the final reward when the medium is more numerous. We will discuss our theory and hypotheses more in detail later in the theory section but in a nut shell we propose medium numerosity as a moderator and predict that more numerous mediums are more effective. In order to single out the effect of medium numerosity we will keep the return on effort or spending fixed, and will manipulate only the numerosity in our experiments.

Likewise, one can argue that Best Buy's reward scheme is also less demanding cognitively in the sense that it is much easier to see the relations between money spent, points earned and the rewards received. For instance, in Best Buy's program the relation between money spent and points earned is very clear and easy to comprehend as each dollar spent is awarded with one reward point. This makes also the return calculation relatively simple as one needs to divide $400 by $5 only. On the other hand, HBC rewards each dollar spent with 50 points which makes the relation relatively more complex as in this case one should first divide 80,000 by 50 to determine how much money one should spend in order to receive $10 gift

certificate. Cognitive complexity is another moderator that we aim to study in this thesis and we predict that cognitively complex designs are more effective.

2.2. Incentives in Organizations

Incentives are motivational tools to make employees perform a better job or do their tasks faster in order to reach organizational goals (Lusthaus, Adrien, Anderson, Carden, & Montalvan, 2002). Incentives are given to employees for a more than mediocre performance. If an incentive plan is designed and maintained properly, it can improve employees' productivity. Incentive plans induce employees to obtain specific results favorable to organizational goals, which are linked to profit making and customer satisfaction. When there is a rewarding system in a company, employees try to reach the level of performance at which they will be rewarded. Moreover, another advantage of a proper incentive program is that it makes employees accept tasks that they would not accept on their own (Locke, 1968).

Using mediums has become prevalent to reward employees' achievements. Rewards can be something other than money. In this regard, mediums have attracted much attention. Organizations, using any type of incentive structure, have become interested in using mediums. A medium can be a point, voucher, or a token which can be redeemed for any type of reward later. Organizations may utilize mediums in their incentive structures. There are different types of incentives for employees, such as bonuses (cash or non-cash), stock purchase, and profit-sharing.

Bonus plans are linked directly to employee's performance; if she performs well she would receive a bonus. Bonuses are useful to change employees' behaviors especially when strategy of the company is changing (Lawler & Worley, 2006). Mediums can be used when the

incentive program is a bonus. Employees first receive mediums for achieving success, and then they can redeem the medium to a bonus which can be cash or a non monetary reward.

Stock purchase plans allow employees to purchase stocks of the company for a price less than the market price. Effectiveness of the stock purchase plans is less than bonuses in that the payment does not merely depend on the employees' performance but rather influences it by economy and stock market (Lawler & Worley, 2006). Mediums can be utilized in the stock purchase plans as well. The amount of stock that an employee can purchase can be linked to the amount of mediums that she collected which is linked to her performance.

Profit-sharing plans allow employees to have shares in the profit of the company. Profit-sharing and employee ownership plans enhance commitment to a common goal and increase co-operation and creativity in a workplace (Kruse, 1996). This kind of incentive depends on the overall performance of the organization; every employee who owns a part of the organization will benefit from the profit. The advantage of this kind of incentive program is that employees understand how their performance affects the company's profitability. The amount that each employee receives can be weighted by her base salary and her performance. Mediums can be used to mediate an employee's performance to the amount of profit that she can receive.

As we mentioned above, a bonus can be cash, such as salary or hourly wage increment, or it can be non-cash, such as using mediums in a form of points redeemable for consumer goods (Hartman, Kurtz, & Moser, 1994). In another categorization, a bonus can be in a form of a piece-rate, lump-sum, or a hybrid payment (Gans, 2005). The traditional type of an incentive is a kind of bonus paid as a commission to salesmen. Commission is also known as a piece-rate bonus. For example, a salesman would receive a reward for each item he can sell, like 5% of each sale. The reward can be either cash or non-cash. It can be some amount of points, if the reward system

is points and points will be redeemed for cash or gift. Therefore, in a piece-rate bonus system an individual receives a reward for every piece of work he can accomplish successfully, and the rate for each piece of work does not change with the number of pieces.

As opposed to the payments for each part of the performance in piece-rate payment, lump-sum is a single payment for high performance and achieving a certain level of performance toward the organizational target. For example, the salesman would receive a reward after selling a certain number of units; if the salesman can sell 50 units, he will get 5% of his total sale. To use mediums in lump-sum structure, an organization may allot specific amount of mediums for reaching a particular level of success.

Finally, hybrid is another type of bonus payment. We can observe it as a combination of piece-rate and lump sum payments. Hybrid is a kind of piece-rate payment but after achieving a specific level of performance. Consider the salesman example; in hybrid method, he would receive 5% of his sales as a reward for each item he can sell but after selling 50 units. He should first try to sell 50 units in order to receive the 5% reward for each item he can sell over the 50 units. The hybrid is like a lump sum method in that it rewards after reaching a certain number of sales, and it is like a piece-rate in that payments are for each item sold. Any combination of the piece-rate and lump sum payment is known as a hybrid bonus payment. Another example of the hybrid for a salesman could be receiving 3% of the selling of each item on the first 30 units and 7% on the second 30 units. Again in this situation, payments are like piece-rate, it is for each item sold, and the percentage of it depends on the specific number of units that the salesman can sell.

According to what we have discussed so far, there are different types of incentive plans. A company should decide on the type of the incentive to use based on nature of the job and

organizational goals. As we mentioned, organizations reward employees' achievements in order to encourage them to keep putting effort. Rewards can be something other than money. Even if organizations reward employees with money, it is still a medium (Hsee et al., 2003). Money is considered a medium in that it mediates an individual's effort and his desired outcomes. People need money in order to obtain what they need, or what makes them happy. Therefore, money is not the ultimate goal; it is a medium.

In this study, we are eager to investigate under what conditions a medium influences employees' effort better. We move on to the next section to study the medium effect and the relevant literature.

3. Medium Effect

Mediums are similar to conditioned reinforces (Kelleher & Gollub, 1962); if an individual does a desired behavior, while it is not the actual reward for his/her effort he would receive a medium (e.g. tokens or points) immediately (Hsee et al., 2003). Then, once he collects enough mediums, he would receive a reward. For example, imagine a salesman in a company who can receive 10 points for each item he sells. He can have a monetary prize with 300 points. As his final goal is to get the prize, not merely the points, he would try to collect more points by selling more. However, receiving more points would be his immediate goal.

Mediums affect individuals' behavior and choice. Hsee et al. (2003) investigated the medium effect and showed that mediums create illusion of advantageous, illusion of certainty, or illusion of linearity. The medium effect refers to the change in preferences caused by including a medium between an effort and a reward. When there is no medium, an individual's effort (E) leads directly to an outcome (O). In their experiments, Hsee et al. (2003) compared individuals' likelihood of choosing an option over the other one in situations with and without a medium, which he called them medium and control conditions respectively. For two tasks (a short task and a long task for instance) that lead to two different rewards, we can model the control condition as:

$$E_1 \rightarrow O_1$$

$$E_2 \rightarrow O_2$$

In the medium condition, there is a medium between a person's effort and outcome. If M represents a medium, we can show the medium condition as:

$E_1 \rightarrow M_1 \rightarrow O_1$

$E_2 \rightarrow M_2 \rightarrow O_2$

Hsee et al. (2003) modeled the likelihood of selecting a choice over the other one as follows:

$$L(\text{control}) = \frac{O2}{O1} - \frac{E2}{E1}$$

$$L(\text{medium}) = \omega \frac{M2}{M1} + (1 - \omega) \frac{O2}{O1} - \frac{E2}{E1}$$

The first equation refers to a control condition, when there is no medium between an individual's effort and outcome. They used ratios in their models to show that individuals consider advantage of one choice over the other choice.

As it is shown in the first equation, in a control condition individuals' choices depend only on the desirability of output (reward) and the effort needed for the option. However, as the second equation indicates, more factors influence people's choice in a medium condition. Such as, presence of a medium, difference between $\frac{M2}{M1}$ and $\frac{O2}{O1}$, and the relative influence of the medium denoted by the weight ω which is a number between 0 and 1.

In one experiment they showed that mediums can create illusion of advantage by changing a non attractive option to an attractive choice to people. They asked participants to choose between two tasks. One task was shorter and less effortful than the other one. The reward was vanilla and pistachio ice cream for the short and the long task respectively. In the medium condition, respondents were told that they would receive 60 points for the short task, and 100 points for the long task. They were also told that with 50-99 points they would receive a vanilla ice cream and with 100 or more points they would receive pistachio ice cream. Most of the respondents chose the long task in the medium condition than in the control condition. Although respondents liked vanilla ice cream more, they opted for the longer task in the medium condition

in that the medium (more points) made illusion of advantage for the longer task and desirability for pistachio ice cream. This study showed that individuals' choices can be influenced by mediums simply because in the presence of mediums people tend to ignore the final outcomes and focus on mediums. As a result of this attention shift, individuals tend to maximize the medium instead of maximizing the final outcome (Hsee et al. 2003).

Hsee et al. (2003) argued that the narrow bracketing and psychological myopia are the two underlying psychological processes that affect individuals' attention and choices. Read, Loewenstein, and Rabin (1999) referred to "narrow bracketing" as a phenomenon that occurs when a person faces a decision making situation which has several steps; the person focuses on the immediate step and overlooks to assess all consequences. This is what happens when there is a medium between an effort and outcome. People pay more attention and are influenced by the more immediate rewards. This is consistent with psychological myopia reflecting people's tendency to focus on the most immediate information related to their decision and to ignore further information (Hsee et al., 2003). A prominent example of psychological myopia is money illusion. Money illusion refers to people's incorrect assessment of money and economic exchanges based on the nominal evaluations (Fisher, 1928; Shafir, Diamond, & Tversky, 1977). In economic transactions, they see the nominal value, not the real value of money. People tend to judge face value and ignore background information.

Another support for the psychological myopia as being the underlying mechanism behind the medium effect comes from Van Osselaer et al.'s studies (2004). Van Osselaer et al. (2004) looked at the impact of allocation of mediums on individuals' decision making. In one experiment, they showed that subjects were influenced by the first medium given to them and they neglected to assess further mediums. In the experiments participants were asked to choose

between two airline companies which offer miles programs. Both airlines needed 600 points to offer a free trip. The first airline offered a flat schedule of points; 200 points for each trip. The other one had an ascending schedule; 100, 200, and 300 points for the first, second, and the third trip respectively. Although with choosing any of these two airline an individual needed to travel three times to reach 600 points and redeem it for a free trip, the experiment showed that in time of choice subjects were influenced by the current (first) travel points. So, more of the subjects selected the flat schedule. The experiment was repeated with offering subjects the flat rate trips versus a descending schedule, offering 300 points for the first trip and decreasing to 200 and 100 for the second and the third trip respectively. This time, more subjects chose the descending schedule. They were influenced by the points they could have in the first trip. This study showed that changing the schedule of giving the points can change subjects' preferences. Results of the Van Osselaer et al.'s study (2004) showed that when choosing between different options with different point schedules, individuals tend to focus more on the earlier points they receive.

Boysen, Berntson, Hannan, and Cacioppo (1996) found some evidence for psychological myopia in the experiments they conducted with chimpanzees. The chimpanzees were given two dishes of candy, one with a smaller amount of candy and the other one with a larger number of candies. By choosing a larger candy dish, the chimpanzee would receive a smaller reward and by selecting a smaller candy dish, he would have a bigger reward. In fact, there was a reverse reinforcement. Even after several trials, the apes failed to select the smaller candy dish and receive a bigger reward. This experiment is consistent with the self-control literature indicating that children cannot wait for a larger but delayed meal, and they choose the smaller but immediate one (Mischel, Shoda, & Rordriguez, 1989). This is not only true for children; adults also have less self-control for immediate food reinforcers than delayed reinforcers (Forzano &

Logue, 1994). Hence, we can infer that individuals are influenced by what they see first. When there is a medium between an individual's effort and a reward, a person focuses on the medium as the medium is received before the reward.

In addition to impact of mediums on individuals' choice, a medium is considered as a measuring tool for individuals to assess their progress toward their desired reward (Soman & Shi, 2004). Individuals focus on the medium and measure their performance by tracking the number of points they have collected. In the salesman example, the salesman tracks the points he had accumulated and tried to decrease the difference between the collected points and 300 points needed for the desired prize.

As mentioned above, existing research has focused on the medium effect on choice. In this paper we want to use actual effort as a dependant variable instead of the choice. Moreover, we want to investigate conditions under which mediums are more influential. In other words, we are interested in the factors that affect ω in Hsee et al.'s (2003) model. In the following part of the thesis, we will study two potential moderators of medium effect on effort: numerosity and cognitive complexity.

4. Current Research and Hypotheses

Even though medium effect is documented extensively in the literature, research on moderators of this effect is scarce. We want to look into the numerosity and cognitive complexity of a medium as moderators of the medium effect. Next, we will discuss these two moderators in detail.

4.1. Medium Numerosity

The first moderator of medium effect that we want to study in this paper is medium numerosity. Earlier studies show that people judge the nominal rather than the real value of numeric terms. For instance, people's valuation of money depends on the face value of it (Fisher, 1928; Shafir et al., 1977). In monetary transactions people rely on nominal difference between the two currencies to evaluate the real value of the transaction (Wertenbroch, Soman, & Chattopadhyay, 2007). As we mentioned earlier, money itself is a medium. Hence, people pay more attention to medium numerosity rather than its actual value. According to Pelham, Sumarta, and Myaskovsky (1994),"People are especially sensitive to numerosity as a cue for judging quantity or probability" (p.103). This literature already hints to possibility that people might be influenced by the numerosity of a medium.

More important question is whether numerosity makes the medium effect stronger or weaker. In general we predict that more numerous the medium is, the higher its effectiveness. Our idea regarding the effect of medium numerosity is based on people's valuation of mediums. Our tenet is that people might value the medium itself in addition to the rewards. In other words, points, and mediums in general, carry value. We suggest that since points carry value, the more numerous medium carries more value to people. For example, a person is given 10 points for a

unit of success which can be redeemed for $5. We propose that we can expect more effort for achieving the success if we change the medium numerosity from 10 to 50 for the same unit of success and the same reward of $5. Moreover, the psychological myopia literature reviewed in the previous section proposes that people focus on the first part of a reward system. As a medium is received before the reward, individuals might exert more effort if they see the medium as more numerous. They would think that they would achieve a more valuable reward. Hence, we predict that by increasing the numerosity of a medium, the medium effect would be stronger. Our first hypothesis is:

Hypothesis 1: The effect of medium on effort can be increased by increasing the medium numerosity, based on people's valuation of mediums, without changing the rewards.

As we mentioned earlier, the medium effect is presented in Hsee et al.'s model (2003) as:

$$\text{L(medium)} = \omega \frac{M2}{M1} + (1 - \omega) \frac{O2}{O1} - \frac{E2}{E1}$$

We suggest that numerosity would influence ω. More specifically, we propose that higher numerosity would lead to higher ω and consequently more numerous medium influences individuals' decisions more. In the above model, changing the medium numerosity would not influence the ratio $\frac{O2}{O1}$ as the desirability of rewards is not changed. Likewise, if the numerosity of mediums are increased with the same ratio (e.g., doubling them), the ratio $\frac{M2}{M1}$ would remain constant as well. Without changing the tasks, the $\frac{E2}{E1}$ will be constant as well. In our experiments we will keep all three ratios constant and as a result any observed difference in preferences can only be attributed to a change in ω.

Hsee et al. (2003) focused on the existence of medium effect. They compared control condition with the medium condition in order to see the impact of mediums on subjects' choices. On the other hand, we want to investigate the influence of the medium numerosity on individuals' willingness to exert effort. Therefore, we will focus on comparisons of different medium conditions with different numerosity.

4.2. Cognitive Complexity of a Medium

Cognitive complexity is the other moderator of medium effect that we want to study. Cognitive complexity of a medium refers to the degree of difficulty or human time and effort needed to calculate and understand the relations between effort, medium, and a reward (Misra, 2006). We propose that cognitive complexity of a medium can moderate the medium effect. If a medium design is simple, one can easily realize the relations between the medium, effort and outcome, and will be less influenced by the medium. Conversely, if a medium is designed in a way that the relations between performance, medium, and outcome cannot be easily understood and the process needs putting in more time and effort, the probability of a person being influenced by the medium will be higher. For example, a medium for each successful task can be one point which can be redeemed for one dollar. This is much simpler than a medium which is 1.5 points for each successful task that can be redeemed to 2.2 dollars. The second medium design is cognitively more complex in the sense that a person should put more time and exert more effort to understand the relations between performance, medium, and outcome. For instance, in the first medium design a person can easily understand how many points he needs in order to reach a reward worth $10, while this process needs more time and effort for him in the second medium design to realize how many tasks he should successfully accomplish to reach a reward of $10. As illustrated by this example as a heuristic response, cognitive complexity would

make the decision maker focus more on or give more weight to the medium rather than the reward. Hence, when it is cognitively complex for a person to calculate these relations, he would pay more attention to the medium, and try to collect more mediums with the hope of getting more rewards later. Moreover, the psychological myopia and the narrow bracketing phenomenon are stronger when it is difficult to track the relations between effort, medium, and reward.

The more complex medium design leads to the higher cognitive load, however the increase of a cognitive load can result from factors other than the medium design. For example, in a company an employee may have many responsibilities, so his mind is too busy to process the medium relations. We predict that such a person would also be influenced more by a medium than his colleague who has less of a cognitive load.

Therefore, to test the cognitive complexity, we can make the relations between effort, medium, and reward cognitively complex. One possible way to achieve this is to make the calculations of these relations more difficult. So, it would be hard to calculate and track the amounts of effort needed to reach a desired reward. The other possible way is to use multiple mediums. If there is more than one medium between a person's effort and the anticipated reward, an individual needs to put more time and effort to understand the relations. So we propose that the influence of a medium on individuals preferences would be stronger when the relations between effort, medium, and reward is more cognitively complex. We can propose our second hypothesis as:

Hypothesis 2: The effect of medium on effort can be increased by increasing the cognitive complexity of a medium without changing the rewards.

In the coming section, we explain the methods which we used to examine effects of numerosity and cognitive complexity of a medium on medium effects and its influences on subjects' effort.

5. Study 1: Numerosity and Cognitive Complexity (Multiple Mediums)

In the first study, we test the effect of numerosity of a medium and cognitive complexity, operationalized by using multiple mediums, on the medium effect. According to the previous studies and our analysis, we predict that when individuals face a more numerous medium, they would be influenced by the medium more and are more willing to exert effort. Also, we expect respondents to choose the more effortful task, if the medium is more cognitively complex.

5.1. Methodology

One hundred sixty seven students, undergraduate and graduate, at the University of Waterloo volunteered to participate in our paper-and-pencil questionnaire. This study had 2x2(numerosity: low vs. high x cognitive complexity: simple vs. complex) between-subject factorial design to examine effects of the two moderators of the medium effect. In addition to these four treatment conditions, we also had a control condition in which we did not use any medium.

Each participant received a questionnaire in which they were asked to make a choice between a less effortful option and a more effortful option within two different hypothetical scenarios. Our goal is to investigate how individuals' choices differ under different conditions. We want to examine if subjects' willingness to put effort differs when the medium is more numerous, or when the medium is cognitively more complex.

The first scenario depicts a hypothetical volunteer opportunity. Following is a part of the description that participants read:

> There are volunteer opportunities available for the Canada Day celebration. You can register either for the first day, June 30, or for the second day, July 1. The first day volunteers are needed to help set up for the celebration

and have to stay for 4 hours. The second day volunteers will help with event operations and are required for 7 hours. As a token of appreciation, we will give you a gift at the end of the day.

The first day volunteers will receive 5 points for each hour they help. The second day volunteers will receive 10 points for each hour of their volunteer work. We will reward you based on the number of points you have collected. If your points fall in the range of 20 to 69, you can select one of the gifts in the list #1, left hand column of the gift table 1. If you have 70 to 100 points, you can choose your gift from the list #2, right hand column.

Which day do you choose to participate?

A- Volunteering on the first day, June 30
B- Volunteering on the second day, July 1

In this study, both rewards and effort were hypothetical. We used points as a medium between effort and reward in treatment conditions. We manipulated the medium from one treatment condition to another. However, we did not use any medium in the control condition. Participants were randomly assigned to one of these five conditions. [5]

The scenario rewards the participants based on the number of points they collect. For this reason, a gift table, including two columns of gifts for the two days, is attached to the questionnaire. Allocation of points in the four treatment conditions is in a way that participants would have the same gift option for choosing the first day or the second day. Hence, effort needed for each volunteer day and the rewards that a subject can receive for that day is constant among all the 5 conditions. It was only the mediums changing over these conditions.

The second scenario asks respondents to participate in either of the two hypothetical surveys of a company. Participants read the following description:

A company is conducting two online surveys in order to improve its function. The first survey takes 20 minutes to be completed and the other takes 40 minutes. As a token of appreciation, we will give you a gift once you complete the survey.

[5] All conditions questionnaires are presented in the Appendix A

If you choose to participate in the first survey, we will give you 3 points for each minute you put to complete it. If you choose the second survey, we will give you 5 points for each minute of your time on the survey. You will be rewarded based on the number of points you have collected. If your points fall in the range of 60 to 199, you can select one of the gifts in the list #1, left hand column of the gift table 2. If you have 200 to 240 points, you can choose your gift from the list #2, right hand column.

Which survey do you choose to complete?

A- The first survey
B- The second survey

Similar to the first scenario, we used a medium between participants' hypothetical effort (putting time on survey) and hypothetical rewards. The same manipulations to the mediums were applied as in the first scenario. Also, the gifts and effort needed for each survey were the same over all conditions. Therefore, we can observe how individuals' choices alter when the two factors of numerosity and cognitive complexity change. More numerous points were used in the high numerosity condition. To examine the effect of cognitive complexity of a medium, we used multiple-stage medium in the cognitively complex condition. We used tokens in addition to points. Using more than one medium between a person's effort and the desired outcome makes participants put more time and effort into analyzing the consequences and finding out the relations between effort, medium, and outcome. Multiple-component tasks require multiple solution processes, so they increase the cognitive complexity of tasks (Marek et al., 2000).

Summary of the first study with the number of points allocated for each treatment condition in either scenario is presented in Table 1. Note that subjects were told that they will be earning more points in the second day. The medium effect predicts that even though the effort required and the rewards obtained remain the same compared to the control group where

mediums were absent, subjects are more likely to choose the second day (higher effort option) in the treatment groups.

Table 1- *Summary of Study 1*

Volunteer Scenario	**Control Condition:** First day (4 hours) Second day (7 hours) **Low Numerosity Condition:** First day (4 hours)→ 5 points/hour Second day (7 hours)→ 10 points/hour **High Numerosity Condition:** First day (4 hours)→ 50 points/hour Second day (7 hours)→ 100 points/hour **Cognitively Complex Condition:** First day (4 hours)→ 10 tokens→ 2 points/token Second day (7 hours)→ 14 tokens→ 5 points/token **High Numerosity-Cognitively Complex Condition:** First day (4 hours)→ 100 tokens→ 20 points/token Second day (7 hours)→ 140 tokens→ 50 points/token
Survey Scenario	**Control Condition:** First survey (20 minutes) Second survey (40 minutes) **Low Numerosity Condition:** First survey (20 minutes)→ 3 points/min Second survey (40 minutes)→ 5 points/min **High Numerosity Condition:** First survey (20 minutes)→ 30 points/min Second survey (40 minutes)→ 50 points/min **Cognitively Complex Condition:** First survey (20 minutes)→ 4 tokens→ 15 points/token Second survey (40 minutes)→ 5 tokens→ 40 points/token **High Numerosity-Cognitively Complex Condition:** First survey (20 minutes)→ 40 tokens→ 150 points/token Second survey (40 minutes)→ 50 tokens→ 400 points/token

5.2. Results

The Number of respondents and their choices in the five conditions are summarized in Table 2.[6] As a dependent variable through our analysis, we calculated the number of the more effortful option that respondents chose over the two scenarios. In other words, we considered the total number of choice B that each respondent made which can be 0, 1, or 2.

Table 2- *Results of Study1*

Scenario 1-Volunteer Opportunity				
		Number of Participants	*Choice B-More Effortful*	
			Number	*Percentage*
Control Condition		35	8	23%
Treatment Conditions	Low Numerosity & Cognitively Simple	32	19	59%
	High Numerosity	33	24	73%
	Cognitively Complex	34	20	59%
	High Numerosity & Cognitively complex	33	25	76%

Scenario 2- Survey				
		Number of Participants	*Choice B-More Effortful*	
			Number	*Percentage*
Control Condition		35	14	40%
Treatment Conditions	Low Numerosity & Cognitively Simple	32	18	56%
	High Numerosity	33	26	79%
	Cognitively Complex	34	20	59%
	High Numerosity & Cognitively complex	33	22	67%

The preliminary finding of the study supports the medium effect; the number of respondents who chose the more effortful choice is more when there is a medium. We compared

[6] Raw data of the first study is presented in Appendix B.

the control condition with all the 4 treatment conditions. The percentage of respondents choosing the less and the more effortful option in control condition and the treatment conditions is shown in Table 3.

Table 3- *Control Condition versus Medium Condition*

		Choice A-Less Effortful	*Choice B-More Effortful*
Volunteer Scenario	Control Condition	77%	23%
	Treatment Conditions	33%	67%
Survey Scenario	Control Condition	60%	40%
	Treatment Conditions	35%	65%
Merged Scenarios	Control Condition	69%	31%
	Treatment Conditions	34%	66%

The proportion of subjects who chose the less effortful option (i.e. the first day) and the more effortful option (i.e. the second day) in the control condition versus treatment conditions within the volunteer scenario is shown in Figure 1. The same comparison within the survey scenario is presented in Figure 2. Figure 3 shows the comparison chart based on the merged data set of the two scenarios.

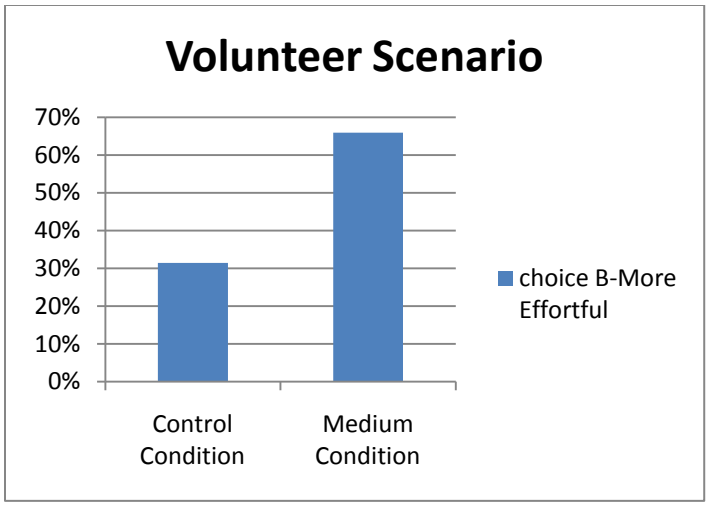

Figure 1- Volunteer Scenario- Control Condition vs. Medium Condition comparison

Table 4- *Volunteer Scenario- Chi-Square Test for Comparing the Control Condition vs. Medium Conditions*

	Value	df	Asymp. Sig.(2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	21.72	1	0.00		
Continuity Correction	19.97	1	0.00		
Likelihood Ratio	22.08	1	0.00		
Fisher's Exact Test				0.00	0.00
Linear-by-Linear Association	21.59	1	0.00		
N of valid cases	167				

Statistical data analysis shows that the number of subjects who chose the more effortful option in the control and the medium conditions is significantly different. We observed this significant difference in the volunteer scenario (χ^2=21.72, p<0.001), survey scenario (χ^2=7.28, p<0.007), and in the analysis of the merged data of both scenarios (χ^2=27.13, p<0.001).

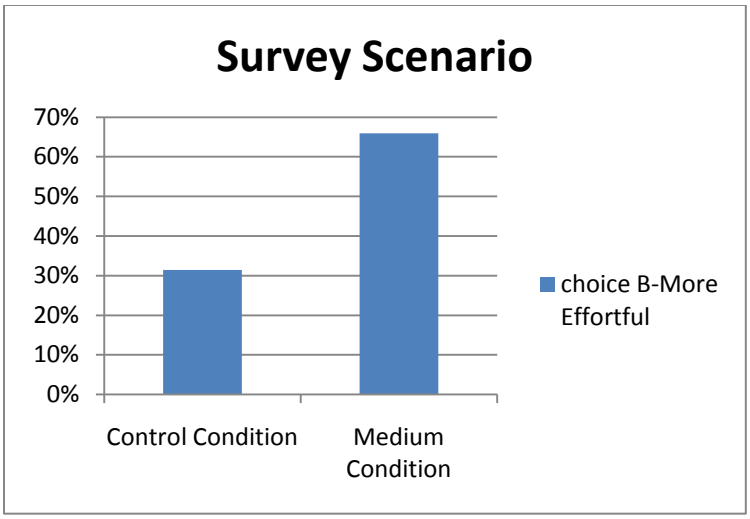

Figure 2- Survey Scenario-Control Condition vs. Medium Condition comparison

Table 5- *Survey Scenario- Chi-Square T-test for Comparing the Control Condition vs. Medium Conditions*

	Value	df	Asymp. Sig.(2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	7.28	1	0.007		
Continuity Correction	6.27	1	0.012		
Likelihood Ratio	7.15	1	0.007		
Fisher's Exact Test				0.011	0.006
Linear-by-Linear Association	7.24	1	0.007		
N of valid cases	167				

Table 4, 5, and 6 present results of the chi-square test for comparing the control condition versus the medium conditions for the volunteer scenario, survey scenario, and the merged scenarios respectively. These results are consistent with the medium effect.

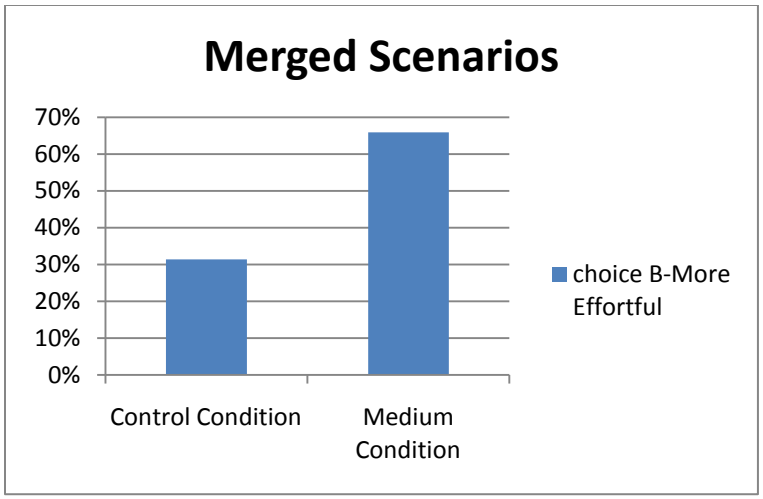

Figure 3- Merged Scenario Data- Control Condition vs. Medium Condition comparison

Table 6- *Merged Data of Both Scenarios- Chi-Square Test for Comparing the Control Condition vs. Medium Conditions*

	Value	df	Asymp. Sig.(2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	27.13	1	0.00		
Continuity Correction	25.72	1	0.00		
Likelihood Ratio	26.96	1	0.00		
Fisher's Exact Test				0.00	0.00
Linear-by-Linear Association	27.04	1	0.00		
N of valid cases	334				

We hypothesized that the medium effect would be stronger under a more numerous medium. Hence, we predict that in a high numerosity condition, subjects are more willing to choose the more effortful option (choice B) than in the low numerosity condition. Also, we hypothesize that cognitive complexity of a medium moderates the medium effect. We predict that we would have stronger medium effect when the medium is cognitively more complex. We have two independent variables and each variable has two levels. Therefore, we conducted a 2x2 factorial ANOVA test. The dependent measure was the total number of the more effortful option, choice B, chosen by respondents. ANOVA revealed a significant numerosity main effect

($F(1,128)=6.76$, $p< 0.01$), but not a significant cognitive complexity main effect ($F(1,128)=0.092$, $p<0.76$). As Table 7 indicates, the interaction effect is non-significant ($p<0.63$).

Table 7- *ANOVA Results for Study 1*

Dependent Variable: Choice B

Source	Type ||| Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3.17	3	1.058	2.35	0.07
Intercept	229.205	1	229.205	510.55	0
Cognitive	0.0401	1	0.041	0.092	0.76
Numerosity	3.035	1	3.035	6.76	0.01
Cognitive*Numerosity	0.102	1	0.102	0.22	0.63
Error	57.463	128	0.449		
Total	290	132			
Corrected Total	60.636	131			

Under high numerosity condition, respondents chose the more effortful option more often (M=1.47) compared to the low numerosity condition (M=1.17). Also, they chose the more effortful option more often under the cognitively simple condition (M=1.34) than the complex condition (M=1.29). The profile plot of the more effortful option (choice B) by numerosity and cognitive complexity is presented in Figure 4.

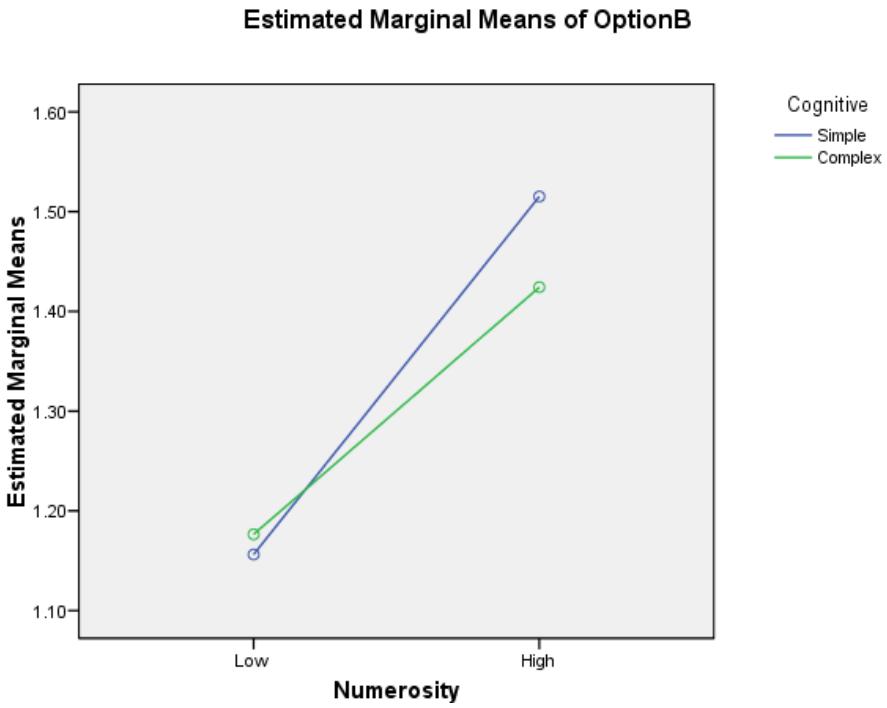

Figure 4- Profile Plot

5.3. Discussion

Results of Study 1 replicate the medium effect (Hsee, 2003): respondents are more willing to take part in the more effortful option when there is a medium than in a control condition

As the ANOVA test revealed, participants in the high numerosity condition showed more willingness to put time and effort in than those in the low numerosity condition. This result supports our first hypothesis indicating that a more numerous medium makes the medium effect stronger.

ANOVA result of Study 1 did not support our second hypothesis. So, we can conclude that cognitively complex medium in the form of multiple mediums do not make the medium effect stronger. This can be because participants focused on the most immediate part of mediums, and ignore the other phases. In other words, the psychological myopia makes

respondents notice the first medium. Therefore, we designed the second study to examine the effect of cognitive complexity on the medium effect by making the calculations of effort, medium, and reward complex.

6. Study 2: Cognitively Complex (Difficult to Calculate)

In Study 1, we examined how numerosity affects individuals' willingness to put effort. Also, we used multiple mediums to investigate the impact of cognitive complexity on the medium effect. We did not observe any main effect of using multiple mediums on subjects' choices in putting effort. In Study 2 we conduct a questionnaire in order to test the effect of cognitive complexity when it is hard to calculate the relations between a medium, effort, and reward[7].

6.1. Methodology

Participants consisted of seventy eight undergraduate and graduate students at the University of Waterloo. They answered a paper-and-pencil questionnaire describing a hypothetical three-day volunteer opportunity. We had two conditions in this study: cognitively simple versus cognitively complex mediums. Subjects were randomly assigned to one of the two conditions. Participants in the simple condition read the following:

> The University of Waterloo has announced volunteer opportunities for graduate and undergraduate students, which can be carried out over the course of three days. The purpose of this initiative is to assist the university with cleaning up before start of the fall term. There are diverse tasks that you can choose from, including painting the walls and railings, cleaning the walls from old posters, etc.
>
> If you are interested in participating, you can choose three days by your choice. Each day you can work for any number of hours, from 1 to 8 hours. As a token of appreciation, the university will reward you at the end of the three-day volunteer session. The reward plan is as follows. For each hour you work, you will be awarded a certain number of points. At the end of the three days, your points will be summed and you will be allowed to choose a reward from the table on the next page, based on the number of points you have collected.
>
> Each day for the first four hours you work, you will earn 200 points per hour. For each additional hour after the forth hour, you will receive 300 points.

[7] The questionnaire of the study 2 is presented in Appendix C.

How many hours are you willing to work on each day?

Please indicate your preference by selecting the number of hours for each day.

First Day	1 hour	2 hour	3 hour	4 hour	5 hour	6 hour	7 hour	8 hour

Second Day	1 hour	2 hour	3 hour	4 hour	5 hour	6 hour	7 hour	8 hour

Third Day	1 hour	2 hour	3 hour	4 hour	5 hour	6 hour	7 hour	8 hour

In order to examine the effect of cognitive complexity on the medium effect, we manipulated the medium in the complex condition. To do so, we changed the points in a way to be more complicated to do the calculations. As it is shown above, in the simple condition the points are round numbers. We changed the 200 and 300 points in the simple condition to 197 and 294 points respectively in the complex condition. As we observed the numerosity effect in Study 1, we decreased the points in the complex condition in order to eliminate the effect of numerosity. Also, to prevent the numerosity effect, we did not make much difference between the points in the simple and complex condition. Similar to Study 1, in this study the scenario, effort, and rewards are all hypothetical. Subjects are asked to indicate the number of hours that they would like to work on each day. Number of hours they choose as their preference to work indicates their willingness to exert effort. We expect subjects in the complex condition to insert more work hours than subjects in the simple condition.

6.2. Results

We summed the hours that subjects indicated as their preference for the three volunteer days to compare their willingness to put effort in to the two conditions. Table 8 summarizes the

results from study 2. As Table 8 shows, the mean of the total number of hours that participants mentioned as their preference to work is higher in the cognitively complex group[8].

Table 8- *Summary of the Results of Study 2*

Total number of hours that subjects are willing to work

	Number of respondents	Mean (st. dev.)
Cognitively simple condition	38	15.63 (-6.18)
Cognitively complex condition	40	18.65 (-5.42)

We conducted a *t*-test in order to compare the mean of the indicated hours in the two treatment conditions. Results of the *t*-test revealed a significant difference between the mean value of the hours in the two conditions (t (76) =2.29, p<.024).

6.3. Discussion

Result of Study 2 supports our second hypothesis. As we predicted, when a medium is cognitively complex, in form of being hard to calculate the relations between effort, medium, and reward, the medium effect is stronger. People try to maximize the number of points they can earn in hope of getting a better reward. Hence, cognitive complexity makes subjects try more and put more effort into the given tasks.

[8] Raw data of the study 2 is presented in Appendix D

7. General Discussion

Previous studies indicate that mediums can affect individuals' choices. This influence is known as medium effect. The research pursued by this thesis manipulated two moderators of the medium effect: Numerosity and cognitive complexity. Moreover, we focused on individuals' efforts as a dependent factor. First, we hypothesized that a more numerous medium makes the medium effect stronger. In the second hypothesis, we suggested that a more cognitively complex medium makes the mediums more effective.

In order to test our proposed hypotheses, we conducted two studies. Our studies had different treatment conditions where the two factors of the numerosity and cognitive complexity of a medium were manipulated. Both studies used between-subject designs. We manipulated both moderators in the first study. Primarily, Study 1 provided further evidence on the medium effect, that is, in the presence of a medium subjects were more influenced by the medium and they were more willing to put effort. Study 1 provided very strong support for our first hypothesis which posited when a medium is more numerous it has more influence on preferences. Subjects had higher willingness to put in effort when we used a more numerous medium. In Study 1, we compared multiple mediums versus a single medium in order to examine the effect of the cognitive complexity. Results of Study 1 did not support our second hypothesis that a more cognitively complex medium (operationalized by multiple mediums) makes the medium effect better. However, hypothesis 2 was supported in Study 2. In Study 2 we tried to manipulate only the cognitive complexity of a medium. In the second study we operationalized cognitive complexity by making the relations between effort, medium, and reward harder to calculate. Indeed, results of Study 2 showed that subjects were more influenced by the medium when it was hard to calculate and track the relations than in the simple condition.

Our second hypothesis was not supported in Study 1, using multiple mediums and it was supported in the second study, when the relations were hard to be calculated. This inconsistency can be easily explained by the psychological myopia phenomenon. According to the psychological myopia, individuals focus on the most immediate phase of a multiple stage decision making and ignore to assess further stages. We believe that in our first study using multiple mediums, subjects paid more attention to the first medium, and did not consider the second medium.

Although design of a medium and its cognitive complexity has impact on the degree of which a person is influenced by the medium, we should not ignore individuals' differences in cognitive ability. Cognitive ability plays an important role in decision making. Those with higher cognitive ability have more categories in mind used to process information, and are capable of making better discriminations and better analyses (Bieri, 1955). Moreover, men and women have different cognitive abilities. Generally men have higher cognitive ability than women, and they do a better job at math than women (Frederick, 2005). Aside from individuals' different cognitive abilities, cognitive complexity of a medium plays an important role to the extent that a medium influences a subject's effort. People with higher cognitive ability can understand the relations between performance, medium, and reward better and would be less influenced by mediums.

The main contribution of this thesis is that it introduced two moderators of the medium effect: numerosity and cognitive complexity. The thesis showed how manipulation of these two moderators affects the medium effect. Our finding can help managers in organizations devise an incentive program using a medium to increase employees' efforts. It can also be useful for marketing managers to design better loyalty programs using mediums.

8. Limitations and Directions for Future Research

While the present study presented findings on the impact of two moderators of the medium effect, there were certainly some limitations. These limitations need to be addressed in future research.

An important limitation can be conducting hypothetical studies. We asked subjects to imagine a hypothetical scenario with hypothetical rewards, and then express their choice. It would have been useful to conduct real studies using real choices, and real rewards. Although this may not be considered a limitation from a theoretical perspective, a real study might have had better results.

Another limitation of this study is its reliance on a student sample. Our subject pool was some of the undergraduate and graduate students of the University of Waterloo. Conducting a study using employees within organizations and real customers in marketing would have produced more realistic results. Also, the number of subjects was limited in our studies. We asked 167 and 78 students in the first and the second study respectively. Future research would benefit from using the larger and broader sample of participants.

In this thesis, we introduced two moderators of the medium effect. Future research may investigate other factors moderating this effect. Future research might look into individual differences as well. As we mentioned in the previous section cognitive capabilities might influence to what extent people are influenced by mediums.

Our results indicated that a more numerous medium has more influence on preferences. Individuals put more effort when they face a more numerous medium. We have not tested the underlying psychological process for this effect. It might be that more numerous mediums are also more cognitively complex. Our current experiments cannot rule out this possibility. Future

research should also look into this. We should also consider that increasing the medium numerosity can be effective only if it seems reasonable for the promised reward. For example, collecting 3 million points might not sound reasonable and might backfire when the promised reward is just a cinema ticket. Hence, we also predict that increasing the numerosity of a medium independently would not cause for an increase in the medium effect as much, which is to say that there would be an upper boundary for an increase of the numerosity. Future research may consider looking into boundaries of this effect.

Finally, we conducted two studies using two methods to manipulate the cognitive complexity of a medium. In Study 1 we used multiple mediums, and in Study 2 we made the relations between effort, medium, and reward hard to calculate. Future research using other methods to manipulate the cognitive complexity of a medium may provide stronger evidence of impact of the cognitive complexity on the medium effect.

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Appendices

Appendix A- Questionnaire of Study 1

Series A- Control Condition

Q1)

There are volunteer opportunities available for the Canada Day celebration. You can register either for the first day, June 30, or for the second day, July 1. The first day volunteers are needed to help set up for the celebration and have to stay for 4 hours. The second day volunteers will help with event operations and are required for 7 hours.

As a token of appreciation, we will give you a gift at the end of the day. The first day volunteers can select a gift from the list #1, left hand column of the gift table 1, and the second day volunteers can choose one of the gifts from the list #2, the right hand column.

	Number of hours of Volunteering	**Reward**
First Day, June 30	4	From list #1, left column of the gift table
Second Day, July 1	7	From list #2, right column of the gift table

Which day do you choose to participate?

A- Volunteering on the first day, June 30
B- Volunteering on the second day, July 1

Q2)

A company is conducting two online surveys in order to improve its function. The first survey takes 20 minutes to be completed and the other takes 40 minutes. As a token of appreciation, we will give you a gift once you complete the survey.

If you choose to take the first survey, you can select your reward from the list #1, left hand column of the gift table 2, and if you complete the second survey, you can pick one of the gifts from the list #2, the right hand column.

	Number of minutes it need to be completed	Reward
First survey	20	From list #1, left column of the gift table
Second survey	40	From list #2, right column of the gift table

Which survey do you choose to complete?

A- The first survey
B- The second survey

Thank You!

Series B-Low Numerosity and Cognitively Simple Condition

Q1)

There are volunteer opportunities available for the Canada Day celebration. You can register either for the first day, June 30, or for the second day, July 1. The first day volunteers are needed to help set up for the celebration and have to stay for 4 hours. The second day volunteers will help with event operations and are required for 7 hours.

As a token of appreciation, we will give you a gift at the end of the day. The first day volunteers will receive 5 points for each hour they help. The second day volunteers will receive 10 points for each hour of their volunteer work. We will reward you based on the number of points you have collected. If your points fall in the range of 20 to 69, you can select one of the gifts in the list #1, left hand column of the gift table 1. If you have 70 to 100 points, you can choose your gift from the list #2, right hand column.

	Number of hours of Volunteering	Points rewarded per hour
First Day, June 30	4	5
Second Day, July 1	7	10

Points-Reward Table:

	Points in range of 20-69	**Points in range of 70-100**
Reward	From list #1, left column of the gift table	From list #2, right column of the gift table

Which day do you choose to participate?

C- Volunteering on the first day, June 30

D- Volunteering on the second day, July 1

Q2)

A company is conducting two online surveys in order to improve its function. The first survey takes 20 minutes to be completed and the other takes 40 minutes. As a token of appreciation, we will give you a gift once you complete the survey.

If you choose to participate in the first survey, we will give you 3 points for each minute you put to complete it. If you choose the second survey, we will give you 5 points for each minute of your time on the survey. You will be rewarded based on the number of points you have collected. If your points fall in the range of 60 to 199, you can select one of the gifts in the list #1, left hand column of the gift table 2. If you have 200 to 240 points, you can choose your gift from the list #2, right hand column.

	Number of minutes it need to be completed	**Points rewarded per minute of the survey**
First survey	20	3
Second survey	40	5

Points-Reward Table:

	Points in range of 60-199	**Points in range of 200-240**
Reward	From list #1, left column of the gift table	From list #2, right column of the gift table

Which survey do you choose to complete?

C- The first survey

D- The second survey

Thank You!

Series C- High Numerosity Condition

Q1)

There are volunteer opportunities available for the Canada Day celebration. You can register either for the first day, June 30, or for the second day, July 1. The first day volunteers are needed to help set up for the celebration and have to stay for 4 hours. The second day volunteers will help with event operations and are required for 7 hours.

As a token of appreciation, we will give you a gift at the end of the day. The first day volunteers will receive 50 points for each hour they help. The second day volunteers will receive 100 points for each hour of their volunteer work. We will reward you based on the number of points you have collected. If your points fall in the range of 200 to 699, you can select one of the gifts in the list #1, left hand column of the gift table 1. If you have 700 to 1000 points, you can choose your gift from the list #2, right hand column.

	Number of hours of Volunteering	**Points rewarded per hour**
First Day, June 30	4	50
Second Day, July 1	7	100

Points-Reward Table:

	Points in range of 200-699	**Points in range of 700-1000**
Reward	From list #1, left column of the gift table	From list #2, right column of the gift table

Which day do you choose to participate?

A- Volunteering on the first day, June 30
B- Volunteering on the second day, July 1

Q2)

A company is conducting two online surveys in order to improve its function. The first survey takes 20 minutes to be completed and the other takes 40 minutes. As a token of appreciation, we will give you a gift once you complete the survey.

If you choose to participate in the first survey, we will give you 30 points for each minute you put to complete it. If you choose the second survey, we will give you 50 points for each minute of your time on the survey. You will be rewarded based on the number of points you have collected. If your points fall in the range of 600 to 1999, you can select one of the gifts in the list #1, left hand column of the gift table 2. If you have 2000 to 2400 points, you can choose your gift from the list #2, right hand column.

	Number of minutes it need to be completed	**Points rewarded per minute of the survey**
First survey	20	30
Second survey	40	50

Points-Reward Table:

	Points in range of 600-1999	**Points in range of 2000-2400**
Reward	From list #1, left column of the gift table	From list #2, right column of the gift table

Which survey do you choose to complete?

A- The first survey
B- The second survey

Thank You!

Series D- Cognitively Complex Condition

Q1)

There are volunteer opportunities available for the Canada Day celebration. You can register either for the first day, June 30, or for the second day, July 1. The first day volunteers are needed to help set up for the celebration and have to stay for 4 hours. The second day volunteers will help with event operations and are required for 7 hours.

As a token of appreciation, we will give you a gift at the end of the day. The first day volunteers will receive 10 tokens at the end of the day, and the second day volunteers will receive 14 tokens for that day. Your tokens will be redeemed to points. If you are first day volunteer, you will earn 2 points for

each token you have. If you are a second day volunteer, you will receive 5 points per token you have. We will reward you based on the number of points you have collected. If your points fall in the range of 20 to 69, you can select one of the gifts in the list #1, left hand column of the gift table 1. If you have 70 to 100 points, you can choose your gift from the list #2, right hand column.

	Number of hours of Volunteering	**Tokens rewarded**
First Day, June 30	4	10
Second Day, July 1	7	14

	Each Token awarded in the first day	**Each Token awarded in the second day**
Redeem to points	2	5

	Points in range of 20-69	**Points in range of 70-100**
Reward	From list #1, left column of the gift table	From list #2, right column of the gift table

Which day do you choose to participate?

A- Volunteering on the first day, June 30
B- Volunteering on the second day, July 1

Q2)

A company is conducting two online surveys in order to improve its function. The first survey takes 20 minutes to be completed and the other takes 40 minutes. As a token of appreciation, we will give you a gift once you complete the survey.

If you choose to participate in the first survey, we will give you 4 tokens, and if you choose the second survey, we will give you 5 tokens. You can redeem your tokens to points. You will be rewarded based on the number of points you have collected afterward.

If you finish the first survey, you will earn 15 points for each token you have. If you select the second survey, you will receive 40 points for each token you have. You will be rewarded based on the number of points you have collected.

If your points fall in the range of 60 to 199, you can select one of the gifts in the list #1, left hand column of the gift table 2. If you have 200 to 240 points, you can choose your gift from the list #2, right hand column.

	Minutes needed to be completed	**Tokens rewarded**
First Survey	20	4
Second Survey	40	5

	Each Token awarded for the first survey	**Each Token awarded for the second survey**
Redeem to points	15	40

	Points in range of 60-199	**Points in range of 200-240**
Reward	From list #1, left column of the gift table	From list #2, right column of the gift table

Which survey do you choose to complete?

A- The first survey
B- The second survey

Thank You!

Series E- High Numerosity and Cognitively Complex Condition

Q1)

There are volunteer opportunities available for the Canada Day celebration. You can register either for the first day, June 30, or for the second day, July 1. The first day volunteers are needed to help set up for the celebration and have to stay for 4 hours. The second day volunteers will help with event operations and are required for 7 hours.

As a token of appreciation, we will give you a gift at the end of the day. The first day volunteers will receive 100 tokens at the end of the day, and the second day volunteers will receive 140 tokens for that

day. Your tokens will be redeemed to points. If you are a first day volunteer, you will earn 20 points for each token you have. If you are a volunteer in the second day, you will receive 50 points per token you have. We will reward you based on the number of points you have collected. If your points fall in the range of 2000 to 6999, you can select one of the gifts in the list #1, left hand column of the gift table 1. If you have 7000 to 10000 points, you can choose your gift from the list #2, right hand column.

	Number of hours of Volunteering	**Tokens rewarded**
First Day, June 30	4	100
Second Day, July 1	7	140

	Each Token awarded in the first day	**Each Token awarded in the second day**
Redeem to points	20	50

	Points in range of 2000-6999	**Points in range of 7000-10000**
Reward	From list #1, left column of the gift table	From list #2, right column of the gift table

Which day do you choose to participate?

A- Volunteering on the first day, June 30
B- Volunteering on the second day, July 1

Q2)

A company is conducting two online surveys in order to improve its function. The first survey takes 20 minutes to be completed and the other takes 40 minutes. As a token of appreciation, we will give you a gift once you complete the survey.

If you choose to participate in the first survey, you will receive 40 tokens, and if you choose the second survey, you will receive 50 tokens. You can redeem your tokens to points. You will be rewarded based on the number of points you have collected afterward.

If you finish the first survey, you will earn 150 points for each token you have. If you select the second survey, you will receive 400 points for each token you have. You will be rewarded based on the number of points you have collected.

If your points fall in the range of 6000 to 19999, you can select one of the gifts in the list #1, left hand column of the gift table 2. If you have 20000 to 24000 points, you can choose your gift from the list #2, right hand column.

	Minutes needed to be completed	**Tokens rewarded**
First Survey	20	40
Second Survey	40	50

	Each Token awarded for the first survey	**Each Token awarded for the second survey**
Redeem to points	150	400

	Points in range of 6000-19999	**Points in range of 20000-24000**
Reward	From list #1, left column of the gift table	From list #2, right column of the gift table

Which survey do you choose to complete?

A- The first survey
B- The second survey

Thank You!

Gift Table 1- for the Volunteer Scenario

List # 1	List # 2
 Canada Day Mug	 Canada Day Backpack
 Canada Day Cap	 Canada Day T-Shirt
 Canada Day Key Holder	 Canada Day Sports Duffle Bag

Gift Table 2- for the Survey Scenario

List # 1	List # 2
 Candles	 Travel Bag
 Photo Album	 Wall Clock
 Coffee Mug	 Pen Set

Appendix B – Raw data of Study 1

In the following tables, A and B represent choice A (the less effortful option), and choice B (the more effortful option) respectively

Control Condition		
	scenario 1- Volunteering	**scenario 2- Survey**
subject 1	A	A
subject 2	A	A
subject 3	A	A
subject 4	A	A
subject 5	A	A
subject 6	A	A
subject 7	A	A
subject 8	A	A
subject 9	A	A
subject 10	A	A
subject 11	A	A
subject 12	A	A
subject 13	A	A
subject 14	A	A
subject 15	A	A
subject 16	A	A
subject 17	A	A
subject 18	A	A
subject 19	A	A
subject 20	A	B
subject 21	A	B
subject 22	A	B
subject 23	A	B
subject 24	A	B
subject 25	A	B
subject 26	A	B
subject 27	A	B
subject 28	B	A
subject 29	B	A
subject 30	B	B
subject 31	B	B
subject 32	B	B
subject 33	B	B

subject 34	B	B
subject 35	B	B

Low Numerosity Condition		
	scenario 1- Volunteering	**scenario 2- Survey**
subject 1	A	A
subject 2	A	A
subject 3	A	A
subject 4	A	A
subject 5	A	A
subject 6	A	B
subject 7	A	B
subject 8	A	B
subject 9	A	B
subject 10	A	B
subject 11	A	B
subject 12	A	B
subject 13	A	B
subject 14	B	A
subject 15	B	A
subject 16	B	A
subject 17	B	A
subject 18	B	A
subject 19	B	A
subject 20	B	A
subject 21	B	A
subject 22	B	A
subject 23	B	B
subject 24	B	B
subject 25	B	B
subject 26	B	B
subject 27	B	B
subject 28	B	B
subject 29	B	B
subject 30	B	B
subject 31	B	B
subject 32	B	B

High Numerosity Condition		
	scenario 1- Volunteering	**scenario 2- Survey**
subject 1	A	A
subject 2	A	A
subject 3	A	A
subject 4	A	B
subject 5	A	B
subject 6	A	B
subject 7	A	B
subject 8	A	B
subject 9	A	B
subject 10	B	A
subject 11	B	A
subject 12	B	A
subject 13	B	A
subject 14	B	B
subject 15	B	B
subject 16	B	B
subject 17	B	B
subject 18	B	B
subject 19	B	B
subject 20	B	B
subject 21	B	B
subject 22	B	B
subject 23	B	B
subject 24	B	B
subject 25	B	B
subject 26	B	B
subject 27	B	B
subject 28	B	B
subject 29	B	B
subject 30	B	B
subject 31	B	B
subject 32	B	B
subject 33	B	B

Cognitively Complex Condition		
	scenario 1- Volunteering	**scenario 2- Survey**
subject 1	A	A

subject 2	A	A
subject 3	A	A
subject 4	A	A
subject 5	A	A
subject 6	A	A
subject 7	A	A
subject 8	A	B
subject 9	A	B
subject 10	A	B
subject 11	A	B
subject 12	A	B
subject 13	A	B
subject 14	A	B
subject 15	B	A
subject 16	B	A
subject 17	B	A
subject 18	B	A
subject 19	B	A
subject 20	B	A
subject 21	B	A
subject 22	B	B
subject 23	B	B
subject 24	B	B
subject 25	B	B
subject 26	B	B
subject 27	B	B
subject 28	B	B
subject 29	B	B
subject 30	B	B
subject 31	B	B
subject 32	B	B
subject 33	B	B
subject 34	B	B

Cognitively Complex & High Numerosity Condition		
	scenario 1- Volunteering	**scenario 2- Survey**
subject 1	A	A
subject 2	A	B
subject 3	A	B
subject 4	A	B

subject 5	A	B
subject 6	A	B
subject 7	A	B
subject 8	A	B
subject 9	B	A
subject 10	B	A
subject 11	B	A
subject 12	B	A
subject 13	B	A
subject 14	B	A
subject 15	B	A
subject 16	B	A
subject 17	B	A
subject 18	B	A
subject 19	B	B
subject 20	B	B
subject 21	B	B
subject 22	B	B
subject 23	B	B
subject 24	B	B
subject 25	B	B
subject 26	B	B
subject 27	B	B
subject 28	B	B
subject 29	B	B
subject 30	B	B
subject 31	B	B
subject 32	B	B
subject 33	B	B

Appendix C- Questionnaire of Study 2

Series A- Cognitively Simple Condition

The University of Waterloo has announced volunteer opportunities for graduate and undergraduate students, which can be carried out over the course of three days. The purpose of this initiative is to assist the university with cleaning up before start of the fall term. There are diverse tasks that you can choose from, including painting the walls and railings, cleaning the walls from old posters, etc.

If you are interested in participating, you can choose three days by your choice. Each day you can work for any number of hours, from 1 to 8 hours. As a token of appreciation, the university will reward you at the end of the three-day volunteer session. The reward plan is as follows. For each hour you work, you will be awarded certain number of points. At the end of the three days, your points will be summed and you will be allowed to choose a reward from the table on the next page, based on the number of points you have collected.

Each day for the first four hours you work, you will earn 200 points per hour. For each additional hour after the forth hour, you will receive 300 points.

First Four Hours → 200 points/ hour

Second Four Hours → 300 points/ hour

How many hours are you willing to work on each day?

Please indicate your preference by selecting the number of hours for each day.

First Day	1 hour	2 hour	3 hour	4 hour	5 hour	6 hour	7 hour	8 hour

Second Day	1 hour	2 hour	3 hour	4 hour	5 hour	6 hour	7 hour	8 hour

Third Day	1 hour	2 hour	3 hour	4 hour	5 hour	6 hour	7 hour	8 hour

 Coffee Mug	600	 Backpack	3200
 Candles	700	 8 GB Flash Memory	3500
 Umbrella	800	 Toaster	4000
 UW T-Shirt	900	 Electric Toothbrush	4200
 Clock Radio	1000	 Scientific Calculator	4500
 Winter Hat	1500	 MP3 Player	5000
 Reading Lamp	2000	 Bike	5200
 Table Fan	2500	 Digital Picture Frame	5500
 Travel Bag	3000	 Digital Camera	6000

Series B- Cognitively Complex Condition

The University of Waterloo has announced volunteer opportunities for graduate and undergraduate students, which can be carried out over the course of three days. The purpose of this initiative is to assist the university with cleaning up before start of the fall term. There are diverse tasks that you can choose from, including painting the walls and railings, cleaning the walls from old posters, etc.

If you are interested in participating, you can choose three days by your choice. Each day you can work for any number of hours, from 1 to 8 hours. As a token of appreciation, the university will reward you at the end of the three-day volunteer session. The reward plan is as follows. For each hour you work, you will be awarded certain number of points. At the end of the three days, your points will be summed and you will be allowed to choose a reward from the table on the next page, based on the number of points you have collected.

Each day for the first four hours you work, you will earn 197 points per hour. For each additional hour after the forth hour, you will receive 294 points.

First Four Hours → 197 points/ hour

Second Four Hours → 294 points/ hour

How many hours are you willing to work on each day?

Please indicate your preference by selecting the number of hours for each day.

First Day	1 hour	2 hour	3 hour	4 hour	5 hour	6 hour	7 hour	8 hour

Second Day	1 hour	2 hour	3 hour	4 hour	5 hour	6 hour	7 hour	8 hour

Third Day	1 hour	2 hour	3 hour	4 hour	5 hour	6 hour	7 hour	8 hour

Thank You!

 Coffee Mug	590	 Backpack	3135
 Candles	685	 8 GB Flash Memory	3430
 Umbrella	785	 Toaster	3920
 UW T-Shirt	890	 Electric Toothbrush	4115
 Clock Radio	985	 Scientific Calculator	4410
 Winter Hat	1470	 MP3 Player	4900
 Reading Lamp	1960	 Bike	5095
 Table Fan	2450	 Digital Picture Frame	5390
 Travel Bag	2940	 Digital Camera	5880

Appendix D- Raw data of Study 2

subjects	Cognitively Simple Condition			sum	subjects	Cognitively Complex Condition			sum
	Day 1	Day 2	Day 3			Day 1	Day 2	Day 3	
1	2	3	2	7	1	7	8	7	22
2	3	3	3	9	2	5	4	4	13
3	4	5	5	14	3	7	7	7	21
4	8	8	8	24	4	5	3	6	14
5	1	1	1	3	5	6	4	8	18
6	3	4	5	12	6	8	8	6	22
7	5	5	5	15	7	1	1	1	3
8	4	4	6	14	8	6	6	6	18
9	8	8	8	24	9	8	8	5	21
10	8	8	8	24	10	1	4	8	13
11	8	7	4	19	11	6	6	6	18
12	4	5	6	15	12	2	2	2	6
13	2	2	2	6	13	5	6	7	18
14	8	8	8	24	14	3	2	4	9
15	8	8	8	24	15	8	1	8	17
16	8	1	8	17	16	8	8	8	24
17	8	8	8	24	17	8	1	8	17
18	8	8	8	24	18	8	8	8	24
19	1	1	1	3	19	8	8	6	22
20	4	4	7	15	20	8	8	7	23
21	8	8	6	22	21	8	8	8	24
22	6	6	3	15	22	8	8	8	24
23	4	3	2	9	23	8	8	4	20
24	6	6	6	18	24	5	5	5	15
25	2	3	2	7	25	7	6	6	19
26	7	7	5	19	26	6	6	6	18
27	5	5	5	15	27	8	8	8	24
28	6	5	3	14	28	7	8	7	22
29	5	6	5	16	29	8	4	8	20
30	7	6	6	19	30	7	8	7	22
31	8	6	4	18	31	8	6	4	18
32	2	3	4	9	32	8	7	7	22
33	5	3	1	9	33	7	8	7	22
34	4	5	5	14	34	8	8	8	24
35	4	4	5	13	35	2	1	1	4
36	6	7	7	20	36	7	4	7	18
37	8	8	6	22	37	8	8	8	24
38	6	6	6	18	38	8	8	5	21

					39 40	8 8	8 7	5 6	21 21