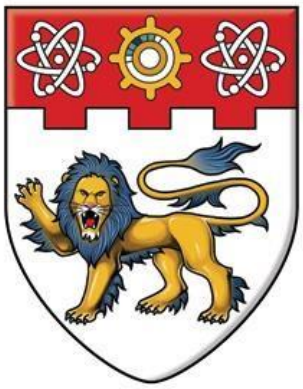

NANYANG TECHNOLOGICAL UNIVERSITY

CONSUMPTION OF ONLINE SERVICES:

CONSUMPTION OF INFORMATION GOOD &

TEAM PERFORMANCE IN ONLINE GAMING

XIAO YUHONG

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Contents

Abstract

Developments in Information Technology has resulted in novel ways to consume products and services over the internet. In this thesis, we looked specifically at the purchase and consumption of information good bundles, and the profession online-gaming scene.

Technology has enabled the purchase and consumption of information goods (e.g. music, journal articles, movies, books) to be done entirely through various digital platforms (e.g. computers, tablets and mobile devices). This has allowed sellers to price differentiate customers based on usage of the information good. Contrary to traditional context of sale where consumption quantity has little economic implication, the consumption quantity of information good on digital platforms has direct cost implication to the seller. In addition, it is presumptuous to suppose that purchase quantity translates fully to consumption quantity. It is therefore important to explore the potential biases that influences valuation and consumption differently. We are concerned with how varying quantity of good can affect valuation and consumption quantity. We discover that quantity of good is a difficult to evaluate attribute and can result in the increase of valuation when varying quantities are compared. We also discover that a quantified quantity (as opposed to unlimited) results in salience of unrealized consumption, and attempts to avoid losses results in higher consumption quantity. Concurrently, quantities that are unreasonable for the consumption context reduces the motivation to avoid loss by suggesting that losses is acceptable in the context. We ran 4 controlled experiments with about 500 participants to study the phenomenon.

The competitive E-sports scene has followed the development trajectory of traditional competitive sports (e.g. basketball, football, hockey). Many professional players now

compete in the scene with salaries paid by their teams as they compete in tournaments with million-dollar prize pool. Motivated by clear monetary benefits, the E-Sports scene provides a natural setting of intact teams for the study of performance of teams. In addition, software patches are periodically applied to most competitive E-sports games. The patches introduce changes to in-game variables and affects how professional players approach the game. As the changes are often introduced centrally game companies, it furthers provides the opportunity to study team performance while controlling for environmental uncertainty. The scene is characterized by a relatively unchanging team performance measure (to win the game). This allows us to study how task experience at the team-level impacts team performance. Literature review reveals that team average task experience and diversity in team task experience have not been studied in diversity research as a moderating variable and a main variable respectively. Focusing on task experience, which reveals quality of cognitive resources, we also study diversity in nationality, which reveals the quantity of unique cognitive resources in a team, and its impact on team performance. We discover that both diversity in task experience and team nationality improves team performance albeit for different reasons. Diversity in team task experience helps in the establishment of hierarchy within teams as it indicates differences in perceived expertise with regards to the team task. While average team task experience improves team performance, it was found to weaken the relationships between the two earlier mentioned diversity variables and team performance. Evidence supporting the findings were found in a dataset of 15,953 professional games played between August 2011 to February 2015.

Chapter 1: Introduction

OVERVIEW

The development of technology has driven new ways to consume products and services over the internet. This has resulted in new digital contexts which are of important business implications and also of research interest. For example, while the purchase and consumption of quantities of good and services are not new, there are limited scenarios where the consumption quantity post purchasing is of economic concern to businesses. However, the consumption of information goods through digital platforms have direct cost implication to businesses. Motivated by the interest in how quantity of goods made available to a consumer may influence the consumption quantity, we investigated the valuation and consumption of varying quantities of information good. The investigated is conducted in paper 1 of the thesis titled "Perils of Comparing Choices: Disparity in Valuation and Consumption Quantity".

The professional E-Sports scene is an unfolding and maturing phenomenon. As of 2015, E-sports is already generating about 400 million dollars of revenue and is poised to reach 1.5 billion dollars by the year 2020 (Deloitte, 2016). Professional players on professional teams owned or sponsored by renown organizations (e.g. Samsung, Razer, Coke, Intel) compete in tournaments with prize pool ranging from tens of thousands to millions of dollars. Motivated by clear monetary benefits, the scene provides a natural controlled setting to study the performance of teams. In addition, the unchanging team performance measure in the games (to win) offers the opportunity to measure task experience of the professionals. This allows us to study the effects of diversity in team task experience and the moderating effects of average team task experience which has not been investigated by prior diversity research. In this thesis, we focus on the moderating effects of average task experience and diversity in team

task experience. Diversity in team nationality is also studied to contrast against the variable of diversity in team task experience. The second essay titled “Good enough to be diverse? Understanding how the quality of cognitive resources impacts the performance of teams” focuses on task experience and its various impacts on team performance.

ORGANIZATION OF DISERTATION

The dissertation consists mainly of three chapters. Chapter one introduces the contexts that motivate the two essays in the dissertation. A brief introduction of the two essays is also given in chapter one.

Chapter two covers the essay titled “The Perils of Comparing Choices” and chapter three comprises the essay “Good Enough to not be Diverse?”. The appendixes and the references of each essay are contained within each chapter.

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Chapter 2: The Perils of Comparing Choices: Disparity in Valuation and Consumption Quantity

ABSTRACT

Utility, the critical underpinning construct of economics, reveals the preference of goods and services and represents the satisfaction experienced by a consumer of a good. Accordingly, during the discussion of an increasing quantity of a desirable good, we expect an increasing valuation as a greater amount of satisfaction can be derived through consumption (higher utility). This presupposed a greater consumption quantity that is yet to be realized during the valuation episode. However, does the valuation necessarily correlates with consumption quantity? This question has great practical significance as bundling has become a common marketing strategy and when the seller has the ability to restrict consumer access to the good. The phenomenon is common and can be found at restaurants, gyms, and a variety of services delivered through the digital medium (e.g. Spotify, Netflix, online journal subscription). Consequently, in this paper, we look at features of the decision-making context that can influence the valuation and consumption of varying quantities of a good. We look specifically at the effect of the presence and lack of alternative options on valuation and consumption quantity on varying quantities of good. We conceptualize three types of quantities that sellers can offer to consumers: achievable, unachievable, and unlimited. Achievable and unachievable quantities represent an amount that are within and greater than the consumption needs of an average consumer respectively. An unlimited quantity is unquantified. It is observed that during valuation, unachievable and unlimited options are valued more when evaluated with other options as opposed to independent valuation. For consumption quantity, we observe that in the absence of comparisons, an unlimited quantity results in lower consumption quantity. Surprisingly, the consumption quantity for achievable option decreases when the options are presented

together. We present the results of four controlled experiments as evidence to the observations.

Keywords:

Behavioural Economics, Valuation, Consumption Quantity

INTRODUCTION

Classical economics is built around the assumption of a rational actor (Simon, 1955) and has motivated utility as a representation of consumers' wants and desires. Utility reveals the satisfaction a consumer gets from the consumption of a good. The concept enabled us to model economic decisions to discover individuals' preference. As utility cannot be measure directly, many measures to elicit the preference of consumers have been developed. The amount a consumer is willing to pay for the good has been one of the de facto measures of utility (Marshall, 1927). Accordingly, increasing quantity of desirable goods will be associated with a higher willingness to pay which reveals a higher utility (Adams & Yellen, 1976). Consumption quantity can also be considered to be a good representation of consumers' wants and desires, with a greater consumption quantity revealing higher utility.

Prior research has established that preferences are not stable and can be shaped by differences in measures of eliciting preference (choosing between options, pricing: willingness to pay, matching) (Bazerman, Loewenstein, & White, 1992; Goldstein & Einhorn, 1987). Similarly, we will expect measuring consumption quantity to influence preferences differently. While we can postulate that the consumption quantity of a quantity of good available correlates positively with utility, the assumption is valid up and only to when the quantity in question is reasonable for the specific consumption context. This raises the question on the relationship between valuation and consumption quantity especially taking into consideration to scenarios where the quantity of good cannot be realistically realized through consumption.

Situations where consumers are presented with options that will result in unrealized consumption are common place. A consumer dining at a buffet restaurant just paid to eat hypothetically unlimited amount of food for a particular dining period. Signing up

for a gym membership usually gives one access to the gym whenever it is opened for the period of the membership. A wide variety of services delivered through digital platforms provides similar options: Netflix provides users unlimited access to its library of movies and TV-series; Digital journals offer consumers various packages that allow them to download a set number of articles a day to unlimited access to their entire database.

The study of sale of large quantity of good is most prominently discussed in the information good bundling literature. Findings of the research is premised on a low marginal cost of information good (Akcura & Altinkemer, 2010; Bakos & Brynjolfsson, 1999, 2000) and a non-negative valuation for every product in the bundle. While the assertions provide a basis for modelling consumers' behaviour, it presumes a rational actor (Simon, 1955) and lacks consideration on the cognitive biases that could occur during the valuation of large and infinite bundles. Also, increasing publishing royalties for music (Owsinski, 2016), which is royalty paid to the music producers and song writers for each individual stream of the song, points to a significant cost of operating a music streaming service that increases with consumers' consumption quantity. This coupled with distribution cost of the service that increases with consumption quantity (a greater amount of digital resources is required to support greater consumption), points to conditions where the assumption that information goods have low marginal cost are invalidated. The lack of consideration of biasness in the evaluation of extremely large and infinite bundles, and the violation of the assumption that information good has low marginal cost, makes it important for us to investigate the effects of varying quantity of good, up to unlimited quantity, on valuation and consumption quantity.

Literature on consumption quantity has shown a large variety of contextual cues to have a positive influence on consumption quantity at generally very reasonable sizes: perceived variety of 6 and 24 colours (Kahn & Wansink, 2004), perceived volume from drink containers of height 3.4cm to 19.7cm (Raghubir & Krishna, 1999), package size of small pack and large pack of cooking oil and spaghetti (Wansink, 1996), actual volume supplied from 250ml to 1000 ml of toilet bowl cleaner (Folkes, Martin, & Gupta, 1993). However, we cannot assume that the same relationship to hold at extremely large quantities. Looking at reasonable sizes only prevents us from understanding the implication of unrealized consumption on consumption quantity.

The discussion of unrealized consumption is dependent on three unique features of the consumption context. Firstly, there must be specific time frame. Be it the number hours for dinning, the month for access to a gym or to a web service, or the number of days till the expiry of a perishable food product; having a pre-defined period of time is important in establishing the quantity of good available and reasonable consumption quantity. Without establishing the episode of where consumption can be realized, the concept of unrealized consumption becomes impossible to conceptualize as with unlimited time, theoretically unlimited quantity of a good can be consumed. Secondly, unrealized consumption requires a mechanism to deny consumers access to the good after the determined period of time. This is important as the concept is reliant on the consumer losing the opportunity to excerpt satisfaction from the good. The restriction can be artificially implemented by the seller, or it can be a characteristic inherent in the good (e.g. expiry of food products). Lastly, there is a need for a natural limit to the consumption quantity. The absence of the constraint implies that consumers can finish consumption regardless of quantity available. Without a natural limit, it becomes irrelevant to establish unrealized consumption as all available good can be consumed.

To look at the effects of unrealized consumption on valuation and consumption quantity, we start by looking at literature that revolves around a large number of goods: bundling. Current research on the bundling of information good suggest that increasing the bundle size results in economic benefits for the seller (Bakos & Brynjolfsson, 1999, 2000). While the findings provide some insights on valuation of extremely large quantities, it does not inform us about the effects of extremely large quantities on consumption quantity. As mentioned earlier, literature on consumption quantity has generally looked at very reasonable sizes, without identifying and considering the effects of unrealized consumption. Our research is among the first to focus on how unrealized consumption can lead to changes in consumers' valuation and more importantly changes in consumption quantity.

Investigating the effects of unrealized consumption will require us to create a framework of different types of quantities that will result in the presence and absence of unrealized consumption. Prior research has recognised that the presence of alternative options influences the preference of consumers (Christopher K. Hsee, 1996; Chrisopher K Hsee, Loewenstein, Blount, & Bazerman, 1999). Therefore, we will also be interested in looking at the effects of the presence of alternative quantities of good on valuation and consumption quantity. It is intuitive that consumers can be presented with multiple options during valuation. Although consumers do not evaluate multiple options during the consumption episode, we expect the alternative options exist as contextual cues and impact how the consumption context is perceived. Phenomenon where alternative options are salience during consumption can be commonly found. Consider two diners who made the same ala carte order, but one requested for take away while the other is eating in at a buffet restaurant. We will expect the diner who is eating in to have a higher saliency of alternative choices. During the consumption

episode, we expect the saliency of alternative choices to introduce a different set of biases that impacts the consumption quantity.

In this paper, we examine the effects of unrealized consumption on the valuation and consumption of large quantities of good. We conducted 4 controlled experiments to investigate the phenomenon. The use of controlled experience allows us to reduce the confounding influences from the environment on the decision-making process.

The remainder of the paper is structured as follow. The next section examines past literature on valuation and consumption quantity. It includes a review on research of bundling which is highly relevant to the context that we are studying. We also review the literature on consumption quantity and theorize the concept of quantity of good driven primarily by the concept of unrealized consumption. Following that, we hypothesize about the relationship between valuation and quantity of good, and consumption quantity and quantity of good respectively. We then describe the experimental studies designed to investigate the hypotheses. Finally, we discuss the results and conclusions of our research.

THEORETICAL FOUNDATION

To examine the effects of unrealized consumption on valuation and consumption quantity, we firstly review the literature on the differences between valuation and consumption quantity. We focus on what past research has established on the bundling of information good as the phenomenon captures the scenario where consumers are required to valuate an extremely large quantity of good. We also looked at the literature on consumption quantity to establish current insights on effects of quantity of good on consumption quantity. We end with a conceptualization of quantity.

Valuation and Consumption Quantity

The current economics literature uses the word consumption loosely to capture the purchase of goods; although strictly the term consumption should represent the usage of a resource.

Extant literature acknowledges the influences of consumption on economic activities. In classic economics, which assumes a rational consumer with a utility maximizing function, the actual act of consumption has been recognized to practically impact the economic decision of an individual (Von Neumann & Morgenstern, 1944). Research has looked at consumptions within temporal proximity (e.g. having a dinner with an entrée and a desert): the attributes an item affects the attributes of another item chosen later (Dhar & Simonson, 1999). It was further discovered that the disassociation of purchase and consumption can reduce the perceived cost of the activity (Richard H. Thaler, 1985; R. H. Thaler, 1999, 2008).

The economic phenomena underlying the extensive streams of research on the purchase or valuation of multiple products and services (bundling and revealed preference) (Adams & Yellen, 1976; Bakos & Brynjolfsson, 1999; Samuelson, 1938,

1948) generally present decoupling between the economic decisions and the actual act of consumption. The decoupling can be temporal (R. H. Thaler, 1999) (e.g. shopping for personal groceries for a week) or agent driven (e.g. shopping for groceries for the entire family). For the earlier mentioned phenomena (i.e. purchase of multiple physical goods), while the consumption behaviour could affect the purchase and valuation of the products, it seldom has any direct economic significance to seller.

The consumption quantity is of economic significance to the seller when cost is accrued by the seller during the actual consumption of the good. For example, there is publishing royalty associated with every individual stream of a music. This means that increased consumption by consumers for music streaming service providers like Netflix, Spotify and iTunes have a significant impact on the business. The current average publishing royalty for music is about 5 cents per 100 plays (Owsinski, 2016) and takes up above 10% of the total revenue of the music streaming industry (Owsinski, 2016). Therefore, sellers of information goods will be particularly interested in how the quantity of good can affect consumption quantity of their consumers. Before we explore the disparity between valuation and consumption quantity, we look at how current literature model economic decisions.

In economics, utility is used to represent consumers' wants and desires. This has enabled us to model economic decisions to discover individuals' preference. Current research has discovered that preferences are malleable and can be shaped by differences in evaluation scale (Bazerman et al., 1992; Goldstein & Einhorn, 1987) and evaluation mode (Christopher K. Hsee, 1996; Chrisopher K Hsee et al., 1999). Evaluation scale refers to the manner in which preferences are elucidated from an individual. Evaluation scale makes it possible to compare an individual's desirability of options (e.g. between option A and B, I like A more than B). Some evaluation

scales include choosing (choosing between alternatives; choosing A), pricing (an individual state how much he/she is willing to pay for an option; pricing A higher than B), and matching (e.g. rating an option's attractiveness from a scale of 1 to 5; rating A higher than B). ***Evaluation mode*** on the other hand refers to the absence and presence of alternatives during evaluation. If alternatives are presented side-by-side evaluation is done in joint evaluation mode When alternatives are presented separately evaluation occurs in separate evaluation mode. It is suggested that concurrent comparisons among choice alternatives accentuate the differences between attributes and hence, attributes which are inherently more complex to evaluate are going to be considered more in joint evaluation mode while less complex attributes are going to be considered more in separate evaluation mode (Evaluability Hypothesis). While preferences are malleable, literature has also recognized that preferences are often stable (Bettman, Luce, & Payne, 2008). Preference stability is often premised on either a prior, accessible, or diagnostic attribute available for retrieval (Feldman & Lynch, 1988) or similar inputs for establishing the preference is used over varying occasions (Schwarz, 2007). This further points to reasons for valuation to differ from consumption quantity.

Classical economic theories prescribe that utility is a good proxy for consumption as utility maximization will lead to consumers' actions to purchase (and consume) items which maximize their utility (Samuelson, 1938, 1948). However, just as how recent behavioural economics literature has shown that the framing of choice setting (Tversky & Kahneman, 1986) and difference in evaluation scales to affect preference stability, we can expect consumption quantity, which is decided under a difference choice setting and is measured on a significantly different scale to behave differently. Research in consumption quantity has already recognized that consumption quantity is

highly unstable (Herman & Mack, 1975) and can be highly influenced by environmental cues: package size (Folkes et al., 1993), shape (Kahn & Wansink, 2004), actual volume (Wansink, 1996), perceived volume (Raghubir & Krishna, 1999) and perceived quantity (Wansink, 2004) have all been shown to have an impact on consumption quantity. The literature has discovered that the increase of consumption quantity is not linear with the quantity of good (Folkes et al., 1993; Wansink, 1996). In fact, contradicting effect was found on medium quantity investigated. For a particular range of small, medium and large quantity of a good, the consumption quantity for the medium quantity has been both found to be larger (Wansink, 1996) than and smaller (Folkes et al., 1993) than the option with the large quantity. It is important to highlight that the prior research has focused on the consumption quantity of physical goods (toilet cleaner, M&Ms, cooking oil, spaghetti, etc.) as it aims to replicate a normal consumption scenario. This results in research focusing on reasonable quantity of good without regards to extremely large quantities. This also means that the concept of unrealized consumption has not been explored by prior literature. Extremely large quantities where unrealized consumption is the most prevalent have not been the focus of earlier research.

While we expect the presence of alternative options to affect the contextual cues during consumption episode and accordingly the consumption quantity, the Evaluability Hypothesis (Christopher K. Hsee, 1996; Chrisopher K Hsee et al., 1999), which is developed to reveal consumer preference during the purchase episode, might be insufficient in explaining the effects of evaluation mode on consumption quantity. Intuitively the joint evaluation mode does not seem to translate fully to the consumption context as consumers do not necessary compare every option that is presented to them. Instead consumers make their consumption decision based on a pre-determined option. We recognize that while comparisons between all the options

might not exist during consumption, the alternative options will exist as contextual cues during consumption. In addition to the two conditions of preference stability mentioned above, we expect individuals to have further difficulty in predicting their future consumption quantity of a quantity of good as the consumption can occur across multiple occasions.

Bundling of Information Goods

As the paper focuses on the effects of unrealized consumption, we review prior research on the bundling of information goods.

The economic advantages of bundling information goods have been largely established (Bakos & Brynjolfsson, 1999, 2000; Geng, Stinchcombe, & Whinston, 2005) in prior research. Enabled by the reduction in search cost on the internet (Shapiro & Varian, 1998) and with the development of marketing and sales strategies, some researchers investigated the phenomenon of customized bundling where consumers have the flexibility to decide the components that make up the bundles (Bocksted & Goh., 2012; Hitt & Chen, 2005; Wu, Hitt, Chen, & Anandalingam, 2008; Yuanchun, Shang, Kemerer, & Yezheng, 2011). Others examined the bundling of information goods as it moves toward licensing and subscription models (Jeon & Menicucci, 2006; John Chung & Marvin, 1999).

While the use of quantities of good to differentiate the sale of information goods bundle is relatively new, usage-based pricing strategies have been practiced earlier. Some studies have looked at usage-based pricing as a price discriminating strategy for the sale of information goods (Sundararajan, 2004). Although research has evolved with changes to bundling strategies in the market, but it has not investigated the phenomenon where sellers offer information good bundles with different quantities of

good (e.g. services provided by Spotify, Shuttlestock, iStockPhotos, and most academic libraries subscription has a limit to the number of downloads per day).

Quantity of good posts new questions about the evaluation of information good bundles as sellers can use it also as a price discriminating strategy where sellers can choose to offer one singular package or multiple packages with different quantities of good.

Further, for the case of information goods, the purchase decision is often clearly dissociated from the consumption episode and are both of economic concern to the seller. This makes it important to exam the effects of quantities of good on consumption quantity of information goods services. Prior research (Christopher K. Hsee, 1996; Chrisopher K Hsee et al., 1999) suggests that an individual's decision is affected by the presence/absence of other options. It is hence important to investigate the effects of quantities of good on the valuation of a bundle as well as the consumption quantity under the condition where alternative options are considered separately (separate evaluation mode) and then when they are compared simultaneously (joint evaluation mode).

Different Quantities of Good

Practically, quantities of good in bundles can generally be defined by the number of items (e.g. 3 articles, 4 books, 5 movies) or amount of time (4 hours). The choice of scale has an obvious impact on the valuation of the bundle and the consumption quantity of a consumer. In addition to the varying type of scales, the context and product type also has great implication on the required quantity; it is reasonable to purchase and consume 10 movies in a month but the same cannot be said for 10 e-

books. It is therefore important to have a measure of subjectivity in our theorizing of quantity of good.

Another feature particularity associated with the sale of information good is the option to offer consumers extremely large quantities. This results in scenarios where the quantity offered clearly exits the requirements of a consumer. Such an option will inevitable result in unrealized consumption. Furthermore, sellers of information good have the option to offer theoretically unlimited amount of good to the consumer. For example, subscription to an e-journal gives the consumer unlimited access to every article available. The option is made possible by the negligible marginal cost of distribution (Bakos & Brynjolfsson, 1999). It is important to capture this feature unique to information goods in our theorizing of quantities of good.

With the above two considerations in mind, we defined three subjective types of quantities based on two important characteristics: the presence or absence of unrealized consumption and if the quantity is quantifiable. **Achievable** quantity is quantifiable (finite) and is possible for an average user to consume up to the quantity resulting in the absence of unrealized consumption; **unachievable** quantity is quantified (finite) but is unrealistic or uncommon for an average user to consume up to this limit; **unlimited** quantity provides infinite access with no specific quantity. The definitions consider the demands of the consumers and the characteristics specific to the provision of information good services (ability for sellers to provide unlimited access). These definitions allow us to capture their effects on the valuation and consumption quantity on information goods bundles. The subjectivity of our definition also allows it to be applied to different good and varying market conditions. We

believe these three types of quantity provide a basic theoretical ground to discuss the impact of quantity on valuation and consumption quantity.

HYPOTHESIS DEVELOPMENT

Based on our conceptualization of quantity of good (achievable, unachievable and unlimited) and the theory of evaluation modes (joint vs separate) we developed various hypotheses of their impact on valuation and consumption quantity respectively.

Effects of Quantity of Good on Valuation

Decision-making research in the field of economics has generally either adopted a more theoretical rational actor (Rational Choice Theory) or a more descriptive model which considers the effects of societal, emotional and cognitive factors on decision making (Simon, 1955). While the two streams of research assume different positions, both agree that a larger positive gain (or improvement) will result in higher utility. This can be observed in the value functions of both the Rational Choice Theory and the Prospect Theory (Kahneman & Tversky, 1979). In short, gains and utilities have non-decreasing, monotonic relationships. Naturally, a larger quantity of good offered in an option will give consumers the promise of access to a larger quantity of good, equating to a larger gain. We will therefore expect that options with larger quantity of good to result in higher utility for consumers. As consumers' utility can be revealed through their willingness-to-pay, the higher utility for a option with a greater quantity of good should translate to a higher willingness-to-pay during the valuation process. We will therefore expect the options with achievable, unachievable and unlimited quantities to have increasing valuations respectively. As a baseline hypothesis, in order to ensure that consumer's valuations are not impacted by the availability of other choices, we consider the case whereby consumers price each option separately.

Hypothesis 1: Under separate evaluation mode, a larger quantity of good results in higher valuation.

$$V_{A,SE} < V_{UA,SE} < V_{UL,SE}$$

where $V_{x,y}$ is the valuation of the bundle with quantity type *x* under evaluation mode *y*. *A* is achievable, *UA* is unachievable, *UL* is unlimited, *SE* is separate evaluation mode.

Hsee (Christopher K. Hsee, 1996) proposed that consumers' preferences are susceptible to biases and these biases may result in preferences reversal under different choice settings. Specifically, we may see preference reversal when comparing choices in joint evaluation (options are evaluated side-by-side simultaneously) settings and separate evaluation (options are evaluated separately) settings. This research further suggests that attributes that are complex/ subjective and hence harder to evaluate would hold greater weight during the choice task in a joint evaluation setting compared to in a separate evaluation setting. For example, individuals will find a new dictionary with 10,000 words more attractive than an old dictionary with 20,000 words when the two dictionaries are presented and evaluated *separately*. The condition of the dictionary (new versus old) is an easy attribute to evaluate compared to the number of words the dictionary holds; few people will truly appreciate the value of having 20,000 instead of 10,000 words in a dictionary when the dictionaries were evaluated separately. However, when the two dictionaries are compared, it was noticed that there was a stronger preference for the *older* dictionary with more words.

In the valuation of options with different quantity of good, we propose that the quantity of good to be an attribute that is complex, subjective and difficult to evaluate. Prior research has shown that consumers construct their preferences incrementally

(Beckman et al. 2008) and often consumers do not have an accurate, preconceived notion of how much one will consume in new purchase settings. For example, a priori, first time cell phone users often find it difficult to estimate the amount of "talk-time" minutes or mobile data required per month. This makes it difficult to establish valuation based solely on intended consumption quantity. The quantity of good should have significant influence on valuation that increases in joint evaluation settings from separate evaluation settings.

However, the effects of quantity of good on valuation in joint evaluation settings does not manifest itself simply. The comparison between the different quantity types is essential in driving the increased importance of the attribute. This suggest that the difference between the quantities of good is highlighted in joint evaluation mode and accordingly the gains associated with the increased quantity of good. Accordingly, we expect the differences between valuations of different quantity type to be greater in joint evaluation mode as compared to separate evaluation mode.

Quantity Evaluability Hypothesis (H2a): The differences in valuations between the option with unachievable limits and the option with achievable quantity will be greater in the situation of joint evaluation than in separate evaluation.

$$V_{UA,SE} - V_{A,SE} < V_{UA,JE} - V_{A,JE}$$

Quantity Evaluability Hypothesis (H2b): The differences in valuations between the option with unlimited quantity and the option with achievable quantity will be greater in the situation of joint evaluation than in separate evaluation.

$$V_{UL,SE} - V_{A,SE} < V_{UL,JE} - V_{A,JE}$$

Quantity Evaluability Hypothesis (H2c): The differences in valuations between the option with unlimited quantity and the option with unachievable quantity will be greater in the situation of joint evaluation than in separate evaluation.

$$V_{UL,SE} - V_{UA,SE} < V_{UL,JE} - V_{UA,JE},$$

where *JE* is joint evaluation mode.

The quantity of good attribute has been shown to impacts consumer valuations in instances without comparison as proposed in hypothesis 1. In hypotheses 2a, 2b and 2c, we further posit that the concurrent comparisons across choices accentuate the differences in quantities between the options hence augmenting the importance of quantity of good. Individuals will perceive greater gains from an achievable to unachievable, achievable to unlimited quantities, and unachievable to unlimited quantities with a more salient, concurrent comparison. This result in greater differences between the valuations of options with larger quantities and the valuation of options with lower quantity under Joint evaluation mode, as compared to under Separate evaluation mode.

Effects of Quantity of Good on Consumption Quantity

While the positive monotonic relationship between quantity of good and utility may hold true for valuation, it is presumptuous to assume the same for consumption quantity, especially at extremely large quantity of good. Although one might assume that consumers are likely to consume more of a good which they have a higher utility (hence valuation), the assumption remains an empirical question to be tested at extremely large quantities. Furthermore, various differences in the decision-making contexts of the valuation episode and consumption episode points to various factors that may influence valuation and consumption quantity differently.

In addition to the temporal disjoint between the consumption episode and valuation episode of information good bundle, consumption often happens across multiple occasion (e.g. subscribers of Netflix bundles are not likely to consume the entire bundle just right after the valuation and payment process).

This suggest that parameters of the consumption context that increases the intent to consume, captured through a larger reported consumption quantity, can be expected to result in higher total consumption quantity over the measured period of time. The increase can be a result of an increase in the number of independent consumption episodes and/or consumption quantity during each occasion. We believe measuring the consumption quantity through self-reporting is a sufficient accurate proxy of consumers' actual consumption quantity.

The quantity of good determines the maximum consumption quantity that can theoretically reported. As the quantity of good increases, we can expect unrealized consumption to manifest during the evaluation process of consumption quantity as consumption quantity will start to fall short of the quantity of good available. Unrealized consumption is easily perceived as a loss of opportunity of consumption. As the loss is undesirable (Tversky & Kahneman, 1986), we will expect individuals to decrease unrealized consumption and be motivated to increase their consumption quantity. The motivation to increase consumption quantity by decreasing unrealized consumption is premised on the salience of unrealized consumption and that in turn is dependent on cues that makes unrealized consumption obvious in the consumption context. The presence of a quantified quantity of good makes it easy for a consumer to determine the amount of unrealized consumption that is present. However, the same cannot be said for unlimited quantity. Hence under separate evaluation mode, we

expect consumption quantity to be positively skewed for achievable and unachievable quantities by the motivation to avoid loss from unrealized consumption. We posit that unrealized consumption is difficult to be quantified for unlimited quantity.as it does not provide the basis from which any unrealized consumption is calculated or surfaced.

Both options with achievable and unachievable quantity are under the influence of increase consumption quantity to avoid unrealized consumption. However, the nature of the achievable quantity (generally reasonable for consumers to finish consuming to the quantity of good available), makes it difficult for the full effects of motivation to avoid losses from unrealized consumption to be reflected in the consumption quantity. It is therefore difficult to make a meaningful comparison between the option with achievable and unlimited quantities to demonstrate the effects of salience of unrealized consumption. A more meaning comparison can be made between the option with unachievable quantity and unlimited quantity

> *Salience of Unrealized Consumption (H3): Under separate evaluation, there is greater consumption quantity for a package with unachievable quantity as compared to a package with unlimited quantity.*
>
> $$C_{UA,SE} > C_{UL,SE}$$
>
> where $C_{x,y}$ is the consumption quantity for the package with quantity type x under evaluation mode y.

The absence of salience of unrealized consumption for the option with unlimited quantity discussed in hypothesis 3 is unique to separate evaluation mode. Under joint evaluation mode, the presence of the other quantified quantities makes unrealized consumption salient for the option with unlimited quantity as they quantities provide a

basis to establish unrealized consumption. This results in the motivation to avoid loss and increase consumption quantity for the option with unlimited quantity. The presence of alternative quantities in the consumption context not only makes unrealized consumption salient in the context.

Prior research has shown that visual cues have a major influence on the consumption of individuals (Wansink, Painter, & North, 2005). For example, when presented with a reasonable sized bowl of soup (finite, achievable limit), there is a huge tendency for an individual to finish everything that is in the bowl. However, what if the individual is consuming *the same single* bowl soup purchased in a restaurant while surrounded by others drinking the same soup, but instead from a buffet line? The presence of others consuming the soup under an unlimited circumstance (i.e. from a buffet line), will result in the individual to be aware and perhaps accept that opportunity loss from unrealized consumption is unavoidable. As such, even though he/she has only purchased a single bowl of soup and not from the buffet line, she will be less compelled to complete it.

Accordingly, for the option with achievable quantity, separate evaluation mode encourages increased consumption to the reasonable limit made available (e.g. finishing the last mouth of rest in a bowl). However, under joint evaluation mode, the presence of the alternative unachievable and unlimited quantities highlights that losses are inevitable in the consumption scenario. The acceptance of loss in the consumption context will inevitable reduce the motivation to increase consumption as a result of unrealized consumption (e.g. finishing the bowl of rice in restaurant where other patrons have access to free-flow rice). This will result in a reduction of consumption quantity for the option with achievable quantity from separate to joint evaluation

mode. The same effect will not be observed for the option with unachievable quantity as it is unreasonable to consume up to quantity available. This means that the effects of loss is accepted in the consumption context for the option with unachievable quantity in both separate and joint evaluation mode.

> *Loss Acceptance Hypothesis (H4): Joint evaluation results in lower consumption quantity for packages with achievable quantity as compared to separate evaluation.*
>
> $$C_{A,SE} > C_{A,JE}$$
>
> where *A* is achievable.

Table 1 below shows how different quantity types affects valuation and consumption quantity differently based on the above hypotheses. We can see that there is a clear disparity between valuation and consumption quantity although they could be theoretically represented by utility (desires and wants).

Table 1: Biases in Valuation and Consumption Quantity

Valuation	Consumption	Biases in Valuation & Consumption Quantity
$V_{UA,SE} < V_{UL,SE}$	$*C_{UA,SE} > C_{UL,SE}$	Salience of Unrealized Consumption
$*V_{UA,SE} - V_{A,SE} < V_{UA,JE} - V_{A,JE}$		Quantity Evaluability Hypothesis
$*V_{UL,SE} - V_{A,SE} < V_{UL,JE} - V_{A,JE}$		Quantity Evaluability Hypothesis
$V_{A,SE} = V_{A,JE}$	$*C_{A,SE} > C_{A,JE}$	Loss acceptance

Note: * - behaviour with biasness that were hypothesized. Their corresponding valuation or consumption conditions that traditional rational choice theory will predict are presented for comparative purposes.

METHODOLOGY

We conducted 4 controlled experiments to test our hypotheses. The use of controlled experiments creates an effective circumstance to measure the valuation and consumption quantity of options with different quantities of good; which otherwise would be difficult to surface in a real-world setting. The results from the controlled experiments substantiated the hypotheses under ideal theoretical settings, albeit with reduced realism. We performed separate experiments for individuals' response on valuation and consumption quantity of various options. This simulates the real-world situation where the valuation episode is distinct from the consumption episode. Concurrently, we identified different evaluation modes (separate & joint) to have an impact on the valuation and consumption quantity. Therefore, four controlled experiments were developed to test the four hypotheses.

The experiments were conducted using an online tool on participants residing in the United States. Participants were recruited through online invitation. Each participant is remunerated an average of US$10 hourly depending on the time taken to complete the experiment. The remuneration method encourages participants to answer the questions quickly. This allows the question to capture the most instinctive responds of the participants. We controlled for the gender and age of the participants. In addition, we also controlled for the affluence level of the participants to ensure that it does not impact the findings in any way. Table 2 below shows the demographics of the participants for all the four studies.

Table 1: Demographics of Participants for experiments

	Study 1	Study 2	Study 3	Study 4
Male	65%	63%	53%	64%
Mean Age (Std. Dev)	31 (11.3)	28.4 (10.1)	29.8 (9.8)	32.4 (12.00
Income (< $25,000)	31%	40%	27.5%	27.9%
Income ($25,001 to $50,000)	33%	23%	30.2%	32%
Income ($50,001 to $75,000)	16%	20%	22.1%	20.4%
Income ($75,001 to $100,000)	12%	8%	12.8%	10.9%
Income (> $100,000)	8%	9%	7.4%	8.8%

Movies and TV-series is the chosen focal good for the experiments. The choice is made as we are administering the experiment online and it is a good that most consumers are familiar with (Apple TV, Netflix) purchasing and consuming through digital platforms. This makes it an appropriate choice for the study of valuation and consumption quantity. It is suggested within the experiments that the service provides consumer access to over 100,000 movies and TV-series. This emulates the service offered in natural settings (Netflix). The large quantity of good also allows us to frame the various quantity types as options to respondents (achievable, unachievable and unlimited quantities).

We note that our conceptualisation of quantity types is subjected in nature. Thus, we need to pre-test the quantities chosen for the experiments to ensure their appropriateness. We pre-test a value of 30 movies per month for an achievable quantity and 300 movies per month for an unachievable quantity of good. The pre-test done with 100 respondents. The result shows that 78% and 84% of respondents agreed that watching 30 movies a month is achievable and 300 movies a month is unachievable respectively. 30 and 300 movies per month are used to represent options with achievable and unachievable quantity of good within all four of the experiments to ensure consistency.

Experimental Study 1 - Impact of quantity of good on Evaluation under Separate Evaluation Mode

In the first experiment, we investigated the effect of quantity of good on the valuation of an option under separate evaluation (H1). 100 participants completed the experiment, which required them to state their valuation for each of the option with different quantities of good (Achievable, Unachievable and Unlimited) with a value between US$10 to US$20. The packages were shown to the respondents sequentially and in randomized order. Respondents were required to state their valuation for the shown option before proceeding. This establish that the valuations are done under separate evaluation mode. The randomizing of the order in which the options are presented prevents ordered effect from affecting the findings.

To test for the effect of quantity of good on valuation, we conducted an ANOVA test with valuation as the dependent variable and demographic variables (gender, income level, age) as covariates in the analysis. The result suggest that different quantities of good has a significant impact on the valuation of the package even with control on demographic variables ($F_{(2,297)} = 5.809$, p-value < 0.01). By conducting a within sample t-test for between the valuations for the different options, we can see that individuals are sensitive to the additional utility with higher quantities of good, and gives a higher valuation for options with a higher quantity. There is positive significant difference between the valuation of option with higher quantity and packages with lower quantity of good.

Table 3: Within-subject t-test for valuation in separate evaluation mode

A (mean, SD)	**UA** (mean, SD)	**UL** (mean, SD)	**UA – A** (t-score)	**UL – A** (t-score)	**UL – UA** (t-score)
10.9 (1.86)	12.1 (2.87)	12.9 (3.37)	5.37**	7.03**	3.44**

Note: A – option with achievable quantity, UA – option with unachievable quantity, UL – option with unlimited quantity, **$\rho < 0.01$

The results support hypothesis 1 and demonstrates that during the valuation of options with different quantities of good under separate evaluation mode, individuals are aware of the additional value of greater quantity. This also suggests that providing unlimited quantity of good is indeed a valid sales strategy for sellers looking to maximize the willingness to pay of consumers.

Experimental Study 2 – Impact of Quantity of good on valuation under Joint Evaluation Mode

In the second experiment, we examined how the different quantities of good will impact the valuations of the option under joint evaluation mode (H2a, H2b, & H2c). As such, the options are displayed concurrently to the respondents during the experiment. This allows us to capture the effects of joint evaluation mode on the respond of the participants. Similar to experimental study 1, participants are required to state how much they are willing to pay for each of the option with a value between US$10 to US$20. 100 individuals took part in the experiment.

An ANOVA analysis shows that there are significant differences between the valuations of the options with different quantity of good even after controlling for demographic variables ($F_{(2,297)} = 23.997$, p-value < 0.01). Further analysis of the valuations using a simple t-test shows that similar to the separate evaluation mode, individuals are willing to pay more for higher quantity of good. We see that higher quantity of good results in significantly higher valuation.

We then ran a linear regression on the data from experiment 1 and experiment 2 to see the effects of evaluation mode on the difference in the valuations of the options with higher quantity of good and the package with achievable quantity of good. Joint evaluation mode results in significantly higher differences between the packages with

unachievable and unlimited quantity of good against the package with achievable quantity of good.

Table 4: Within subject t-test for valuation in joint evaluation mode

A (mean, SD)	**UA** (mean, SD)	**UL** (mean, SD)	**UA – A** (t-score)	**UL – A** (t-score)	**UL – UA** (t-score)
11.0 (2.60)	13.5 (2.94)	15.7 (4.00)	10.25**	11.47**	7.43**

Note: **ρ < 0.01

Table 5: Regression of JE on Valuation

Dependent Variable: **Difference in valuation**	**UA(β,SE) - A(β,SE)**	**UL(β,SE) - A(β,SE)**	**UL(β,SE) - A(β,SE)**
Dummy	1.409 (0.333)**	2.737 (0.496) **	1.328 (0.365)**
Gender	0.470 (0.345)	0.568 (0.515)	0.098 (0.378)
Age	0.032 (0.016)	0.026 (0.023)	-0.055 (0.170)
Income	0.191 (0.131)	0.095 (0.195)	-0.965 (0.143)
R_2	0.110	0.140	0.070
R	0.33	0.37	0.265

Note: **ρ < 0.01, Variable: 1 = JE & 0 = SE, Gender: 1 = Male & 0 = Female, Income: 1 < $25,000 & 2 < $50,000 & 3 < $75,000 & 4 < $100,000 & 5 > $100,000 per year

The results support hypothesis 2a, 2b, and 2c as the effect of joint evaluation mode on the difference in valuation are both positive and significant. This supports our Quantity Evaluability Hypothesis; under the joint evaluation mode, individuals are more aware of the differences in the quantity of good. This in turn accentuates the difference in valuations between various quantity types. Hence, providing alternatives of different quantity types during purchase setting should be recommended as it can potentially result in higher profits for sellers.

Experimental Study 3 – Impact of Quantity of Good on Consumption Quantity under Separate Evaluation Mode

For the third experiment, we aim to exam the impacts of different quantity of good on the consumption quantity of individuals (H3). A different set of respondents were asked about their consumption quantity for the different options. Similar to experiment 1, the order of options to be displayed to each participant is randomized before being sequentially shown to them. Of the 150 participants, 3 did not provide complete information resulting in only 147 responds for the analysis.

We ran an ANOVA test with consumption as the dependent variable and demographic variables as covariates. The results shows quantity of good impacts consumption quantity even after controlling for demographic variables ($F_{(2,444)} = 5.017$, p-value < 0.01). The *t*-test of the differences between the options with different quantity of good shows the options with unlimited quantity of good and unachievable quantity of good has higher consumption quantity than the option with achievable quantity of good. The *t*-test also shows a significant negative difference between the consumption quantity of the option with unlimited quantity of good and the option with unachievable quantity of good.

Table 6: Within-subject t-test for consumption quantity in Separate evaluation mode

A (mean, SD)	**UA** (mean, SD)	**UL** (mean, SD)	**UA – A**(t-score)	**UL – A**(t-score)	**UL – UA** (t-score)
19.3 (11.62)	30.0 (34.21)	25.5 (26.45)	4.42**	3.17**	-1.95*

Note: *ρ < 0.05, **ρ < 0.01

The results support hypothesis 3 and show that a quantified quantity of good is important in making unrealized consumption salient, and trigger the motivation to avoid loss associated with unrealized consumption.

Experiments 1 and 3 shows that when choices are evaluated separately, while consumers might pay the most for an option with unlimited quantity of good, their consumption quantity for the option might not be at the greatest. This confirms the disparity between valuation and consumption evaluative processes under separate evaluation mode.

Experimental Study 4 – Impact of Quantity of Good on Consumption Quantity under Joint Evaluation Mode

Finally, we examined how the joint evaluation mode will impact the consumption quantity of the options with different quantity of good (H4). Similar to experiment 2, the options are displayed concurrent to the respondents. 150 individuals participated in the experiment. 2 responds were excluded because of insufficient information resulting in 148 data points.

An ANOVA analysis of the data using consumption quantity as the dependent variable shows that quantity of good results in significant differences in consumption quantity even after controlling for demographic variables ($F_{(2,438)} = 4.779$, p-value < 0.01). Analysis of the data using a *t*-test between the consumption quantity of the options with unachievable and unlimited quantity of good and that of the option with achievable quantity of good shows positive significance results.

However, there were no noticeable difference between the consumption quantity of the options with unachievable and unlimited quantity of good. The results further confirm our theory on the importance of the salience of unrealized consumption on motivating consumption behaviour.

Further Analysis of the data collected in experiment 3 and experiment 4 shows significant and lower consumption quantity for the option with achievable quantity of

good under joint evaluation mode as compared to separate evaluation mode. There are no observable differences for options with unachievable and unlimited quantity of good across the evaluation modes.

Table 7: Within-subject t-test for consumption quantity under Joint Evaluation Mode

A (mean, SD)	**UA** (mean, SD)	**UL** (mean, SD)	**UA – A** (t-score)	**UL – A** (t-score)	**UL – UA** (t-score)
15.2 (8.90)	29.9 (45.92)	30.9 (49.12)	4.18**	4.19**	0.30

Note: **ρ < 0.01

Table 8: Regression of JE on Consumption Quantity

Dependent Variable: Valuation	**A**(β,SE)	**UA**(β,SE)	**UL**(β,SE)
Dummy	-4.281 (1.194)**	-3.991 (4.507)	5.636 (4.619)
Gender	1.743 (1.208)	3.402 (4.559)	4.005 (4.673)
Age	-0.055 (0.054)	0.261 (0.205)	-0. 34 (0.210)
Income	-1.438 (0.481)**	-4.149 (1.814)*	-4.163 (1.860)*
R_2	0.007	0.025	0.026
R	0.08	0.15	0.16

Note: *ρ < 0.05, **ρ < 0.01

The regression of joint evaluation mode on consumption quantity supports hypothesis 4 which suggest that loss acceptance can reduce the motivation to increase consumption from unrealized consumption. Sellers can design the consumption context for consumers whom have bought an option with achievable quantity of good and constantly remind them of potential unavoidable loss in options with unachievable and unlimited quantity of good to reduce their consumption quantity.

DISCUSSION

The findings of the study make various theoretical and practical contributions. We have identified three key implications of the findings. Firstly, the research contributes to the literature on bundling by recognizing the phenomenon of using quantity of good as a price segregation mechanism. Prior research has not started on the discussion. Our conceptualization of quantities of good captures the entire range from one to infinite. The subjectivity nature of our categories (achievable, unachievable and unlimited) allows for application to other good and contexts. We believe that our theorization of the quantity of good, provides the conceptualization necessary for further investigation into this phenomenon.

Secondly, our findings contribute to our understanding of valuation of options with varying quantity of good. We motivate the Evaluability Hypothesis (Christopher K. Hsee, 1996; Christopher K Hsee et al., 1999) to show that the quantity of good is a hard to evaluate attribute which can accentuate the differences between the options with different quantity types. The findings provide a basic understanding of valuation of options with different quantity of good over different evaluation modes.

Thirdly, our empirical findings draw the attention to the differences between valuation and consumption quantity. The digitalization of services increases the importance of understanding the consumers' actual consumption behaviour. We show that there is clear disparity between valuation and consumption quantity although both are theoretically based in utility. Also, we provide empirical evidence that the type of biasness and heuristics that will impact our valuation and consumption quantity are different. Consumption quantity unlike valuation is affected by saliency of unrealized consumption. The salience of unrealized consumption increases consumption quantity as loss is undesirable and a quantified quantity of good plays an important role in

noticeability of unrealized consumption. We demonstrate this by showing that for an option with unlimited quantity of good, when unrealized consumption is not salient in the decision-making context, there is no motivation to increase consumption quantity to reduce unrealized consumption. In addition, loss acceptance within the decision-making context can reduce the motivation to increase consumption quantity to reduce unrealized consumption. The two effects show that consumption quantity can be influenced by factors other than the natural intended consumption quantity of an individual.

The paper also has clear practical implication. Firstly, the research informs consumers on the perils of comparing multiple options when purchasing large bundles of information good with different quantity of good. The comparison of options increases consumers' willingness to pay but it not necessarily matches their actual consumption quantity. Many of us compare our options during purchase but evaluate the options alone during consumption. This is economically unviable if we bought packages with unlimited quantity of good as we will have the highest willingness to pay but our consumption quantity will be underwhelming. Such awareness will help consumers to make better economic decisions. The knowledge can help prevent sellers from manipulating consumers through the design of the purchase and consumption contexts.

From the sellers' standpoint, the research provides basis guidelines into the design of sales strategy for options with varying quantities of good as a price discriminating mechanism. The research suggests that there are clear economic benefits for sellers, with cost that scales with consumption quantity, to provide consumers with multiple options during valuation and remind the consumers the presence of the multiple options during consumption. Also, depending on the good in question, the seller can

design options with achievable, unachievable, and unlimited quantity of good. The table below, provides a practical guideline of our findings on the comparison of how evaluation mode affects the valuation and consumption quantity of options with different quantity of good.

Table 9: Effects of Evaluation mode on the Valuation and Consumption Quantity of different Options

	Achievable	**Unachievable**	**Unlimited**
Valuation	$V_{SE} = V_{JE}$	$V_{SE} < V_{JE}$	$V_{SE} < V_{JE}$
Consumption Quantity	$C_{SE} > C_{JE}$	$C_{SE} = C_{JE}$	$C_{SE} < C_{JE}$

LIMITATIONS AND FUTURE RESEARCH

One of the limitations of the paper is that we have only considered only one type of good: movies and TV-series. Although the choice is appropriate and commonly consumed, the generalizability of the results can still be questioned. However, we believe that the results are generalizable to not only information goods but also other purchase and consumption context. Finding unrealized consumption undesirable is something that is inherent in consumers and it is not dependent specifically on the product or service in question. Future research could look at establishing the boundaries and conditions for which the biases for valuation and consumption exist.

Another limitation of the current research is that we operationalize quantity of good with the unit of good (number of movies). We recognize that there are alternative ways to determine quantity of good. For example, an alternative operationalization can be 30 hours of movies streaming time in a month. Similar to the earlier limitation, we believe that the results are generalizable to other types of quantity of good as we believe the same response to heuristics will be applied towards the evaluation of the gains and losses associated with the other ways of determining quantity of good.

CONCLUSION

In this paper, we expand on our understanding on the differences between valuation and consumption quantity. Experiment 1 show that individuals recognize that increasing quantity of good represents increasing gains and hence higher valuations. In Experiment 2, we show that in joint evaluation mode, comparisons attenuate the differences in valuations between options with different quantity types. Experiment 3 demonstrate that in separate evaluation mode, consumption quantity is affected by the salience of unrealized consumption which encourages consumers to increase consumption quantity. In Experiment 4, we observe that in when losses are accepted in

the decision-making context, the motivation to reduce loss from unrealized consumption decreases resulting in lower consumption quantity. This is revealed in the comparison of consumption quantity of the option with achievable quantity across joint and separate evaluation mode.

APPENDIX A – SCREEN SHOTS OF EXPERIMENTS

Figure A1: Experiment 2, Joint Evaluation of the 3 different packages

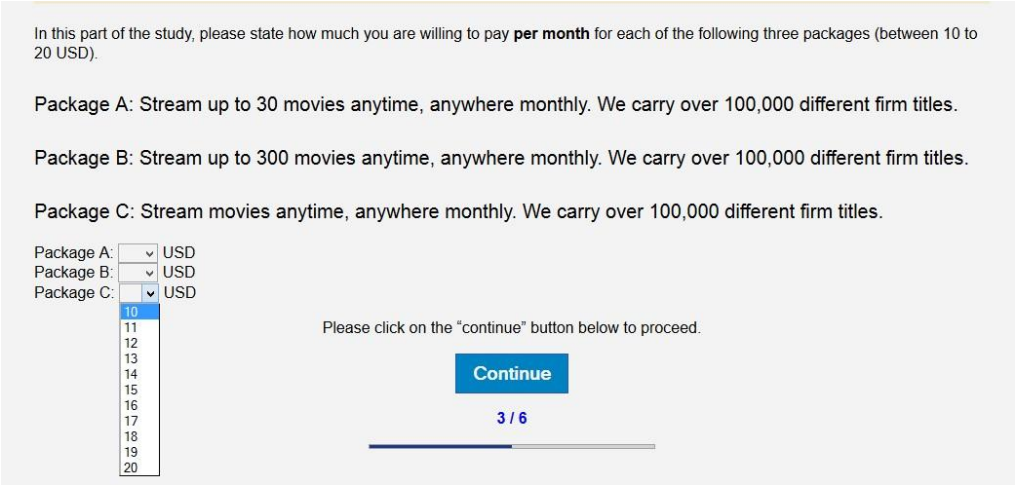


Figure A2: Experiment 3, Separate Evaluation of Achievable Package

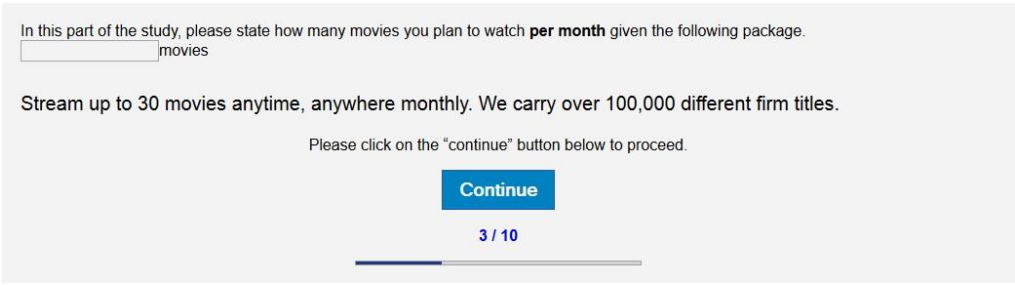


Figure A3: Experiment 3, Separate Evaluation of Unachievable Package

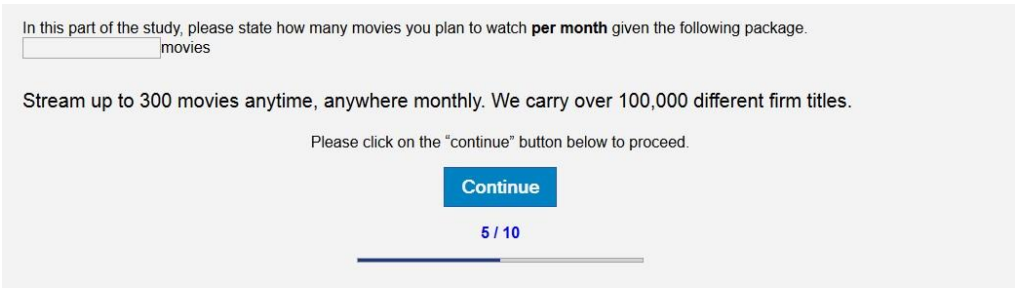
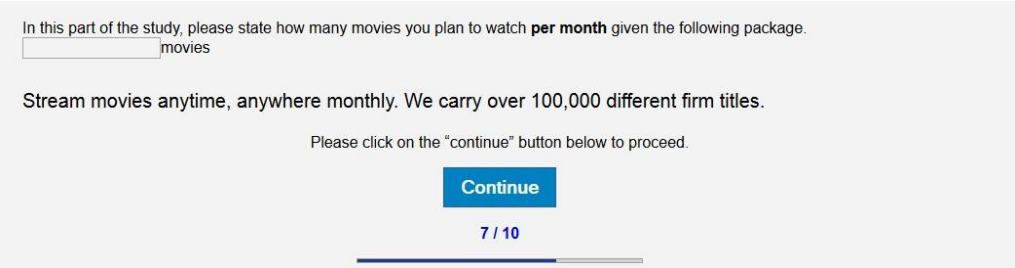


Figure A4: Experiment 3, Separate Evaluation of Unlimited Package



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Chapter 3: Good Enough to not be Diverse? Understanding how the quality of Cognitive Resources impact the performance of Teams

ABSTRACT

Cognitive Diversity Theory (Cox & Blake, 1991; Hambrick, Cho, & Chen, 1996; Hambrick, Davison, Snell, & Snow, 1998), one of the key theories supporting team diversity, suggest that diversity in teams brings about a greater set of unique cognitive resources which promotes creativity, innovation and problem solving. Driven by the theory, team diversity literature has focused on variables that reveal variability in the quantity of unique cognitive resources (functional background, expertise, nationality, etc.), but not in the quality of cognitive resources that teams possess. In this paper, we focused on task experience which reveals the quality of cognitive resources that an individual possesses with respect to the task in question. Specifically, we looked at the effects of task experience diversity on team's performance. We further investigated the moderating effects of average team task experience on diversity of task experience and also its effect on a diversity of team nationality, which is a more commonly studied variable in diversity literature (Earley & Mosakowski, 2000; Hambrick et al., 1998; Nielsen & Nielsen, 2013). We discover that both diversity in task experience and nationality has a positive effect on team's performance. Average task experience also negative moderating effect on the relationship between the two diversity variables and team's performance albeit for different reasons. Evidence was found in the analysis of the 15,953 professional games of Dota 2 (Defence of the Ancients 2) played between August 2011 and February 2015.

INTRODUCTION

Literature is still equivocal on the effects of diversity on teams. Key theories have surfaced in the research in the field. The Similarity-Attraction paradigm (Byrne, 1971) has been often invoked to demonstrate the problems of diversity in teams (Lau & Murnighan, 1998; Price, Harrison, Gavin, & Florey, 2002); differences in attributes of members of a team can result in communication problems and conflict. The Cognitive-Diversity Hypothesis is frequently cited by proponents of team diversity (Cox & Blake, 1991; Hambrick et al., 1996; Hambrick et al., 1998); diversity results in a greater set of unique cognitive resources that promotes creativity, innovation and problem-solving. Functional background of team members (Boone & Hendriks, 2009; Cannella Jr, Park, & Lee, 2008), nationality of team members (Nielsen & Nielsen, 2013), and experience diversity (Heyden, Sidhu, Bosch, & Volberda, 2012) have all been investigated and explained using the Cognitive-Diversity Hypothesis as the variables are reflective of the quantity of unique cognitive resources that is possessed by a team. However, the effects of diversity in quality of cognitive resources has not been explored by prior literature.

The quality of cognitive resource possessed is revealed by task experience. A higher team task experience has been deemed to result in better team performance as individual members has higher ability in performing the task (Littlepage, Robison, & Reddington, 1997). Parallels can definitely be drawn between the quality of cognitive resource and also the ability in performing a task. The lack of theoretical consideration in quality of cognitive resources and absence of research on task experience in team diversity literature reflects that the current literature does not discerned between the quality of the cognitive resources at both the individual and team level. Specifically, it is presumptuous to assume that diversity affects teams with different level of

competency in similar ways. Hence, this paper investigates the effects of task experience on team performance. In order to contrast the effects of quality of cognitive resources against quantity, we have also studied Nationality, which has been identified as a diversity variable that results in greater set of unique cognitive resources, in this paper.

We have situated the study in a novel context: professional Electronic Sports (E-Sports). Digital games are no longer purely a source of entertainment for leisure purposes. An E-sports (electronic sports) scene has developed around some popular games like Counter Strike: Global Offensive (CS: GO), Defence of the Ancients 2 (DOTA 2), League of Legends (LOL), and StarCraft 2. The games each has their own fan base with LOL leading the scene with more than 67 million unique users playing the game every month in 2014. A flourishing community has developed around the games consisting not exhaustive of amateur gamers, professional gamers, team managers, sponsors, casters, analysts, and reporters. For example, a top CS: GO tournament attracted up to a million viewers during the live streaming of the event in 2015.

Competitive gaming as a career gained legitimacy with businesses operating professional gaming teams and putting professional gamers under employment. In Korea, large telecommunication companies and familiar brand names like Samsung sponsors StarCraft 2 teams as the competitions are broadcasted live on dedicated TV channels and the internet. Professional gamers are not only paid a salary; they are also incentivized by the by the prize pool of the tournaments. The International 5, the largest DOTA 2 tournament of 2015, broke the prize pool record of E-sports with a prize pool above 18 million USD with the winning team walking away with 6.6

million USD. With a large prize pool, professional gamers have a clear motivation to 2perform. The growth of E-sports community has also gained corporate attention.

Global E-sports revenue is estimated to reach $1.9 billion USD by 2017 (Gaudiosi, 2015). With its audience already rivalling that of second-tier traditional sports like swimming and ice hockey ("The E-sports Economy Will Generate At Least $465 Million in 2017," 2015), the e-sports community is developing into a business and an advertising channel that corporations cannot ignore. Major brands like Red Bull, Coke Zero, Intel, and Razor have all embraced the community and have invested money into the scene through the form of sponsorship, and advertising.

The E-sports phenomenon offers an interesting context to study the relationship between team diversity and team performance that is motivated by clear monetary incentive. For CS:GO, LOL and DOTA 2, teams competing against each other are not only responsible for their in-game strategy choice but also the execution of the strategy. At the same, each game is determined by a definite win and loss. The unchanging objective performance measure allows us to do a longitudinal study of the effects of task experience on team performance. It also allows us to compare team performance across teams as long as we control for the opponent's skills. Hence in this study, we aim to investigate the relationship between the selected team characteristics and the team's performance. This allows us to compliment earlier diversity research by highlighting the effects of task experience on team performances in a real-world setting motivated by clear monetary incentive.

Furthermore, the games are characterized with balance patches[1] that introduces new in-game variables or change current in-game variables. The changes to the in-game

[1] Balance patches differ from bug fix patches that aim to ensure that the game function as intended.

variables introduced by the balance patches are analogous to changing poker hand order by making a straight larger than a full-house or making diamond the largest of the four suits. The introduction of new in-game variables will be similar to introducing increasing number of cards in a poker deck by adding a fifth suit. The balance patches are introduced to keep the games novel by introducing variance in the gameplay. The patches are periodically released and gamers are usually required to update their client system to play on the latest patch. This means that the in-game environment that teams are competing in is always held constant at any given point of time. This further emulates a constantly evolving work place and allow us to base our investigation in a context that captures varying levels of environmental uncertainty. The presence of the balance patches in E-sport provides us with the natural field opportunity to study team diversity in an environment where we can control for environmental uncertainty.

Most importantly, the task (winning the game) stays reliably constant for the context. This allows us to do a longitudinal study on the effects of task experience. In this study, we start by exploring the effects of diversity of task experience on team performance. We proceed to focus on the moderating effects of average team task experience on the relationship between diversity in task experience and diversity in nationality on team's performance. Nationality diversity has been studied in prior literature in team diversity (Earley & Mosakowski, 2000; Hambrick et al., 1998; Nielsen & Nielsen, 2013) and shown to improve team outcome as prescribed by the Cognitive-Diversity Hypothesis. The inclusion of the variable in the study allows us to differentiate the moderating effects of average task experience on the traditional team diversity variable and diversity in team task experience.

In the following section, we further describe the E-Sports phenomenon and give a brief introduction of the dataset used in the paper. We then proceed to conceptualise

diversity of team task experience and diversity in team nationality. We further conceptualise average team task experience. Next, we develop hypotheses that describe the relationships between the diversity in team task experience and team nationality on team performance and the moderating effects of average team task experience on the earlier relationships. Subsequently we present our empirical models and results of analysis. We conclude with a discussion of the theoretical and practical implications of the findings.

THE E-SPORTS PHENOMENON

The development of profit models related to digital games has come a long way. The simplest model that most of us are familiar with is the sale of electronic games to be played on digital platforms (E.g. Play Station, Xbox, and Personal Computer). In the 1970's, a new profit model for digital gaming appeared as people pay to play the coin operated machines in digital arcades. This demonstrated the potential of making digital gaming a paid service. The paid service model was further developed into a monthly subscription model most notably by the game World-of-Warcraft.

Newer profit models that does not require end users to pay directly for the entertainment of digital games has arisen. Free-to-play casual games, like Candy Crush, are popular with mobile gamers. Instead of charging the end-users directly for the purchase of the game, the game makes its revenue stream from in-game advertising and purchases. Many multiplayer competitive games (E.g. Dota 2, League of Legends, Hearthstone, Heroes of the Storm) have also been released to the market at no cost. Instead, the games generate the majority of its revenue stream from the purchase of in-game items. It is therefore important for such games to attract a larger audience. In order to grow the competitive games' community and keep it vibrant and active, competitions are organized. As the competitive scene grew larger, it created alternative revenue streams similar to traditional sports: advertising revenue from corporate sponsorship and sale of broadcasting rights. For example, in South Korea, top StarCraft 2 tournaments are broadcasted on dedicated television channels with the major telecommunication companies and large conglomerate like Samsung heavily invested into their teams that carry their brand names. The importance and growth of the competitive scene is further enhanced by the development of real time streaming services like twitch.tv. As the reach and viewership of the competitive scene grew,

more companies hope to gain exposure in the scene by being involved in it. The competitive E-Sports scene has been widely recognized as an advertising goal mine as it give companies exposure to tens of millions of consumers on a regular basis (Deloitte, 2016).

In this paper, we study the E-sports scene of Dota 2. Dota 2 belongs to the genre of multiplayer online battle arena (MOBA), where each game consists of two competing teams each with five players. Our primary dataset contained all recognized competitive games played between August 2011 and February 2015 consisting of 13773 games. Other than basic information (e.g. team names, player identification and game result), the dataset also consists information about the strategies chosen by the teams for the specific game, revealed by their pick and bans of in-game characters[2] for the particular game. As players can change their in-game identification and some of the game data might be inaccurate, a lot of effort is put into data cleansing and the identification of the players. We further extended the dataset by documenting the nationality of each uniquely identified player. In addition, we documented all the 29 balance patches that are introduced between August 2011 and February 2015. As balance patches are released globally on the same day, we are able to proxy for environmental uncertainty with the number of days between when the game was played and when the previous nearest balance patch was released.

[2] In a Dota 2 competitive game, each team takes turn to select from the hundred plus in-game characters available. Five characters are picked by each team exclusively. The game is than played with the selected characters. This process is the drafting phrase which is extremely strategic in nature. The picks are called the draft of the game which is similar to picks in football or baseball match line-ups.

CONCEPTUAL BACKGROUND

We begin by highlighting discussing the key theories studied in the field of diversity research. We follow that by highlighting the attempts by prior research in studying task experience and the difficulties in studying team task experience in a real-world phenomenon. This is followed by an examination of works related to Nationality in team diversity research. We finally review the research on diversity for team level moderators.

Key Theories

Despite the quantity and quality of research on the effects of team diversity on team performance (Ancona & Caldwell, 1992; Kochan et al., 2003; Mannix & Neale, 2005; Milliken & Martins, 1996), the field has been equivocal on the effects of the team diversity on team performances. The major theoretical paradigm supporting demographic diversity in teams suggest that information diversity in team with a greater set of cognitive resource will result in better decision-making (Cognitive-Diversity Hypothesis) (Cox & Blake, 1991; Williams & O'Reilly III, 1998). The differences in the team characteristics serve as indicators of a larger pool of knowledge and differing perspectives. This allows team decision making to base of a greater wealth of information therefore improving team performances on a task.

On the other hand, research has also developed multiple theories discussing the effects of homogeneity in teams. The similarity-attraction paradigm (Byrne, 1971) suggest that homogeneity in teams promotes communication because of mutual attraction within members of the team. More recent theoretical models include social identity theory (Tajfel, 1982) and self-categorization theory (Turner, Hogg, Oakes, Reicher, & Wetherell, 1987) suggest that individuals make in-group/out-group distinction on the basis of their similarities and may favour cooperation with in-group members. It has

also been suggested that demographic fault-lines, which are 'hypothetical dividing lines that may split a group into subgroups based on one or more attributes (Lau & Murnighan, 1998), can exacerbate the perceived differences within subgroups of the teams.

One of literature's attempt to reconcile the differences between the competing theories include the conceptualization of task-related demographic variables versus non taskelated demographic variables (Pelled, 1996; Pelled, Eisenhardt, & Xin, 1999). Even so, meta-analysis of the literature still produced (Horwitz & Horwitz, 2007; Webber & Donahue, 2001) inconclusive results. Webber & Donahue (2001) found no conclusive evidence between demographic diversity and team performance while Horwitz & Horwitz (2007) found task-related demographic diversity to be quality and quantity measures of team performance. Recent research delved into the conceptualization of diversity in-order to determine the effects of demographic diversity on team performance (Bell, Villado, Lukasik, Belau, & Briggs, 2010; Harrison & Klein, 2007). Three conceptualizations of diversity were proposed: separation reveals differences in position or opinion among team members (described along a continuum), variety represents differences in kind or category, primarily of information, knowledge, or experience (categorical differences) and disparity embodies and differences in concentration of value assets or resources. It was found that functional background variety diversity had a slight positive relationship with team performance. Educational background variety diversity had an influence on team creativity, innovation and the performance of top management teams.

On closer inspection of the theory supporting diversity in teams, it focuses on the quantity of unique cognitive resources without consideration of the quality of the cognitive resources. This ignores the effects of diversity in quality of cognitive

resources on team performance and also the does not provides insight on how the team's average quality of cognitive resources influences a team performance. For example, we will clear expect teams with greater quality in cognitive resources with respect to the team task to be better at communication. Individuals with greater experience and ability with respect to the team task to be able to communicate better with others while working on the team task resulting in better team performance.

The importance of understanding how the quality of cognitive resources impacts teams is highlighted by the task experience variable (number of times an individual has done a similar task). Task experience has been demonstrated by prior research to be highly related to expertise on the task (Littlepage et al., 1997) by improving the knowledge and strategies (Goldstein, 1993) that one employs on the task. This suggest that while an accumulation of task experience at an individual level implies a greater **quantity** of task experience, advocating it as a greater set of cognitive resources might not be the most appropriate. Instead, the greater expertise with regards to the task will be better articulated as an individual having a better quality with regards to the cognitive resources associated with the team task. Studying task experience, which reveals the quality of cognitive resources possessed by an individual with respect to a task, will potentially result in further insights in the diversity literature and also potentially provides a bridge between the two opposing perspectives of diversity.

Task Experience as a Diversity Variable

Task experience has been differentiated from other form of work experiences like job and organizational experiences (Quińones, Ford, & Teachout, 1995). Task experience has been widely shown to have a positive impact on performance at the individual level (Dunlosky & Hertzog, 2000; Lance, Hedge, & Alley, 1989; Rakestraw & Weiss,

1981). While the same relationship has been shown to hold for the average task experience of teams in a lab (Littlepage et al., 1997), there are limited research done for teams in natural settings. This hints at some possible difficulties in studying the task experience of teams in natural settings.

The reliance of teams as operational units in organizations has grown with the investigation of teams. Prior literature has also looked at the intricacies of measuring team performance (Brannick & Prince, 1997). In a natural setting, teams usually fulfil multiple roles and objectives that changes with context and time. Driven by the phenomenon, researchers usually measure team performance "as what seems to be useful to the purpose at hand at the time of study" (Cannon-Bowers, Tannenbaum, Salas, & Volpe, 1995). Concurrently, it has been observed that the act of measuring team performance usually requires some form of time and expense (Brannick & Prince, 1997). These factors highlight the evolving nature of team task in natural settings with different and changing context, making it very difficult to study the effect of team task experience on team performance. Although it is possible to control for the team task in lab experiments, prior literature has also highlighted the difference between observations made in labs in and natural setting (Dobbins, Lane, & Steiner, 1988). In particular, prior research has shown that intact teams behaviour differently from laboratory teams (McGrath, 1984). This explains the absence of research on the impact of team task experience in the team diversity literature which has focused primarily on organization teams in natural settings. The lack of research prevents us from understanding how diversity in task experience affects how teams operate in natural settings.

Experience in teams has been widely studied at the individual and group level on its relationship with performance. In diversity research, experience has generally been

measured using tenure, which is the period of time an individual is exposed to a particular context. Different types of tenure have been identified: team tenure, organization tenure, job tenure. The impact of experience diversity on team performance has not been definitive (Jackson, Joshi, & Erhardt, 2003). On one hand, the cognitive diversity hypothesis argues that cognitive diversity among team members promotes innovation, creativity and problem solving which results in better team performance. On the other, Social Identity Theorem highlights the cost of diversity in teams and its impact or team dynamics resulting in poor team performance. Literature has shown that individuals with similar job tenure can have drastically different task experience (Ford, Quiñones, Sego, & Sorra, 1992; Schmitt & Cohen, 1989). Therefore, we cannot presume that prior works on experience in diversity literature and task experience share the same correlation with job performance at the team level.

Nationality as a Diversity Variable

In this paper, we look at the nationalities of the individuals within the team as the diversity variable to contrast against task experience diversity within a team. The choice is motivated in part by availability of the data and also by the fact that diversity in nationality has usually invoked the Cognitive-Diversity Hypothesis to explain its positive effects on team performance (Hambrick et al., 1998; Nielsen & Nielsen, 2013). The inclusion of the variable in the study allows us to differentiate between the effects of quantity (revealed by nationality) and quality (task experience) of cognitive resources on a team's performance.

Previous research has classified nationality differently: as bio-demographic diversity (Horwitz & Horwitz, 2007), relations-oriented diversity (Joshi & Roh, 2009), demographic diversity (Kilduff, Angelmar, & Mehra, 2000), or surface-level diversity (Price et al., 2002). The categorizations generally refer to diversity that is not-related

to the functional task and are easily observed (e.g. age, race, gender), aiding individuals in the social classification of themselves and others.

Regardless of the classification of the variable, nationality diversity has been shown to have an influence on effective performance (Earley & Mosakowski, 2000), innovation (Gibson & Gibbs, 2006) and the various aspects of information use (range, depth, and integration) (Dahlin, Weingart, & Hinds, 2005). Nationality diversity has also been demonstrated to be important in Top-management teams albeit moderated by firm and industry conditions under which strategic decision are made (Nielsen & Nielsen, 2013). Nationality has been argued to be an integrated part of an individual's selfidentity, consequential through a shared meaning system with others of the same nationality (Shweder & LeVine, 1984). Individuals who share the same nationality has also been suggested to have a greater commonality in their informal institution experiences (Hofstede, 1980; Hofstede, Hofstede, & Minkov, 1991) and resultantly from a common national culture. It has also been proposed that a formal institutions experiences from a similar nationality has an impact on an individual's functioning in a team. Formal institution experience formulates the basic strategies of interaction between actors with regards to information sharing, behaviour monitoring, and assessment of corporative behaviour (Scott, 2008) and have an enduring effect on an individual. The institutional experiences of team's members affect the set of unique cognitive resources possessed by a team.

Team Level Moderators: Average Task Experience as a Moderator

Within team diversity research, Joshi (Joshi & Roh, 2009) did a meta-analysis of contextual factors that past research considered. The paper established three main levels of context variables: team, organization, and industry levels. A multitude of variables has been considered in prior studies on their possible influence on the

relationship between diversity and team outcomes. The team-level contextual factors can be broadly classified into team processes, team task characteristics, team leadership and other team characteristics. In interest of the discussion of the paper, we will focus on the team task characteristics contextual factors that are considered in prior research. Task routineness (Pelled et al., 1999), team task type (Reagans & Zuckerman, 2001), task complexity (Jehn, Northcraft, & Neale, 1999; Kearney, Gebert, & Voelpel, 2009), task interdependence (Ainoya, 2004; Kearney et al., 2009) and their effects on the relationship between diversity and team outcomes have all been investigated by prior research. As articulated in the earlier discussion of team task experience, the evolving nature of work place contexts makes it difficult to compare the task experiences across teams and time. Lack of insights on the impact task experiences as a moderator also prevents us from differentiating between how teams with high and low task experience operates. Accordingly, it does not inform us about how differentiate teams with a better quality of cognitive resources and teams with a lower quality of cognitive resources.

Specially, the effects of demographic diversity were found to be stronger in teams with higher average team tenure. It has also been shown that negative effects of diversity are found to be weaker terms that have spent more time together (Jackson et al., 2003). Team tenure is still not indicative of the moderating effects of task experience as the earlier focuses on the relational aspect of the team, without consideration on the quality of cognitive resources possessed by the team.

HYPOTHESES DEVELOPMENT

Diversity in Team Task Experience vs Team Nationality

Team Task Experience Diversity and Team Performance

It is common for the team to have some autonomy in deciding the direction and actions of the team. Naturally, teams develop some form of hierarchical structure in order to facilitate the operation of the team (i.e. leaders and followers). Prior research has shown that individual level characteristics like intelligence influences the emergence of leadership (Lord, De Vader, & Alliger, 1986). The personality traits of the leader (e.g. knowledge of the business) has also been shown to impact the effectiveness of the leader (Kirkpatick & Locke, 1991). The emergence of leadership and effectiveness of the leader sequentially are positively related to the performance of team.

Greater task experience diversity within a team points to differences in the task experiences of individuals within a team on similar tasks (Littlepage et al., 1997). Task experience of an individual is a readily observation attribute that will contribute to perception of the individual by other team members (Price et al., 2002). Accordingly, we will expect an individual with higher task experience to be perceived as having greater expertise on the task. Just as how intelligence influences the emergence of leadership, we will also expect an individual with greater perceived expertise on the task to emerge as a leader. Similarly, while we expect higher job knowledge of a leader to contribute to better leader's effectiveness in a team, we will also expect the difference between the knowledge the leader and his/her members to contribute to authority and leader's effectiveness.

Followers in a team will also benefit from the diversity in task experience. For example, when an individual recognizes another in the team to be have greater expertise, intuitively we will expect the individual to be more comfortable in a

follower role and be more receptive of the leadership. This in turn will contribute to the team's performance. We expect such an effect to apply to more than a simple leader-followers' relationship in a team. The interaction and cooperation in a team happens at more than the team-level. The occurrence of sub-group interactions, each with its own unique social dynamics will surface its own hierarchical structure. The diversity within the task experience of the members of team will serve to contribute to the effectiveness of the leader role in all such interactions.

Task experience focuses on the experience of an individual with similar task. As such, a greater task experience diversity within a team does not imply a greater disparity in unique job knowledge within the members of the teams (Harrison & Klein, 2007), where members have a greater set of unique job knowledge. It suggests that a greater set of cognitive resources is not collectively available in a team with greater diversity in task experience. This means that the invoking the Cognitive-Diversity Hypothesis to explain the effects of team task experience diversity is inappropriate (Cox & Blake, 1991; Williams & O'Reilly III, 1998).

Just as a longer job tenure does not always translate to greater task experience (Ford et al., 1992; Schmitt & Cohen, 1989), there will also be instances where the evolving job task result in discrepancy between task and job experience. Hence, we will not expect the same relationship to observed with job experience.

> *Hypothesis 1a: Team task experience diversity is positively related to team performance.*

Team Nationality Diversity and Team Performance

The nationality of an individual has been argued to be reflective of the institutional environments of the country that the individual is exposed to (Hambrick et al., 1998). Formal institutions, with explicit and codified rules, and informal institutions ,

revealed by tacit norms and conventions, both guides an individual in the interpretation of situations and decision-making processes (Crossland & Hambrick, 2007). For an individual, the immersion in such formal and informal institutions will inevitably have an impact in shaping the individual's cognition and behaviour. As such, the nationality of an individual is a comprehensive proxy of the effects of exposal to institutional environments, on an individual's cognition and behaviour. We will therefore expect two individuals with the same nationality to have a larger similarity in exposal of institutional environments than two individuals of different nationalities. As such, greater nationality diversity in a team brings about a greater variety of experiences with exposal to a greater and different set of institutional environments. The greater diversity in experiences, perspectives and knowledge allows teams to generate more solutions for complex problems, reduce 'group think' (Burt, 2004), and improve decision making as observed by the Cognitive-Diversity Hypothesis (Cox & Blake, 1991; Williams & O'Reilly III, 1998). Individuals in a team with higher nationality diversity will also be more sensitive to differences highlighted by the difference in nationalities. We will expect individuals to invoke a different set of cognitive processes and behaviours when interacting with others with similar and different nationalities as them. Higher perceived differences results in a more thorough processing of information and decision-making with less assumptions and potentially higher quality decisions (Nielsen & Nielsen, 2013). This is supported by prior research which has shown that nationality diversity in teams encourage in-depth discussion and consideration of alternatives resulting in more innovative solutions (Hambrick et al., 1998).

Hypothesis 1b: Team Nationality Diversity is positively related to team performance.

Average Team Task Experience as a Moderator

Team Average Task Experience and Team Performance

For us to investigate the moderating effects of average team task experience on the relationship between team diversity and team performance, we need to first talk about what prior literature has said about the effects of average team task experience on team performance.

Task experience defined as experience with similar task (Littlepage et al., 1997) can be reflective of an individual's expertise in completing the task. Prior research has recognized task experience as an important contributor to task knowledge. The accretion of knowledge and strategies from previous task experiences builds up task knowledge and an individual's expertise at performing the task. Prior research has shown that the gain in performance with task experience is relevant at the individual level (Burke & Day, 1986; Hellervik, Hazucha, & Schneider, 1992). The same relationship has been shown to be significant at the team level (Gino, Argote, MironSpektor, & Todorova, 2010) albeit only specific to team creativity. It is argued that the prior team task experience increases the ability of team members to communicate ideas and to visualize new combinations of subtasks that members could perform hence improving performance at the creative task (Gino et al., 2010). We believe that the gains could be generalized to other collaborating team tasks. Team task experience will educate an individual on the intricates of collaborating on the team task. In addition, repeated exposal to the team task will inform individuals of the varying aspects (knowledge and processes) that is critical to the success of the team task.

Specifically, in addition to the earlier mentioned aspects of communication and collaboration, we expect the team task experience to equip individuals greater

understanding of the various requirements that is important in fulfilling the team task. This will potentially include knowledge acquisition and adaptation when performing a team task in an evolving context.

Hypothesis 2: Team average task experience is positively related to team performance.

Moderating effect of Average Team Task Experience on Diversity of Team Task *Experience and Team Performance*

In hypothesis 2, we demonstrate that a higher average team task experience has a positive impact on team performance. It can be argued that a team consisting of members which has accumulated a wealth of task knowledge will obviously be preferred in all conditions. Although we might like to form a team with high average task experience, it might not always be realistically possible. Therefore, it is important to understand the scenarios where the relationship between average team task experience and team performance is weaker.

Earlier, we demonstrated how the diversity in task experience helps the emergence of hierarchical structure in team interactions and effectiveness of the leader's role. The formation of the hierarchical structure, the taking on a leadership role, and the taking on the role of a follower are processes are intricacies of performing the team task. This means that the knowledge and ability to operate effectively in the various processes could be gained with team task experience. This suggest that individuals with higher task experience are more comfortable in dealing with the above-mentioned intricacies of the team task. For example, a team of experienced academic researchers will most likely have the knowledge and strategies to cooperate with others while collaborating on a research project. This means that the team is less reliant on a perceived difference in expertise to collaborate on the team task, brought about by diversity in task experience, when collaborating on the team task. On the other hand, when the average task experience in a team is low, we can expect some of members to be less equipped in dealing with the development of hierarchy roles in a team and also their performance in either the leader or the follower role. This means that the team will greater benefit from the perceptive differences in expertise between the members of

team as it allows for individuals within the team to better perform within their respective roles.

Hypothesis 3a: Team Average Task Experience weakens the relationship between Team Task Experience Diversity and Team performance; the relationship is stronger when Team Average Experience is low but weaker when Team Average Experience is high.

Moderating effect of Average Team Task Experience on Diversity of Nationality and *Team Performance*

Hypothesis 1b showed that diversity in nationality improves team performance by improving decision-making in two ways. Firstly, it expands the set of unique cognitive resources that is possessed by the team (Cox & Blake, 1991). The cognitive resources include more than readily application solutions that is relevant to the team task, it also compasses of strategies towards approaches the team task. Specially, we can expect the diverse team to be equipped with more knowledge acquisition strategies that is critical towards completing a team task. Secondly, diversity in Nationality also increases the quality of information-processing and decision-making within a team (Nielsen & Nielsen, 2013).

The key benefits of greater task experience in a team is that it brings about in-depth understanding of the requirements towards the completion of the team task. While it is debatable if there is accompanied with greater set of unique cognitive resources, we can definitely expect a team with greater task experience to have better appreciation of the intricacies required to perform well on task. When a greater set of unique cognitive resources improves team performances, the team will have greater consciousness towards the fact. The awareness will motivate the team towards acquiring novel strategies critical towards knowledge acquisition. Hence, a team with high average task experience will be less reliance on visual differences between team members to achieve a greater quality in information-processing and decision-making. On the contrary, a team with lower average task experience will be more reliance on diversity of nationality to achieve the earlier mentioned benefits.

Hypothesis 3b: Team Average Task Experience weakens the relationship between Team Nationality Diversity and Team performance; the relationship is

stronger when Team Average Experience is low but weaker when Team Average Experience is high.

METHODOLOGY

Data and Descriptive Statistics/Proxies

For this study, we combined data from four different online gaming sources (datdota.com, dota2.gamepedia.com, gosumgamers.com, wiki.teamliquid.net/dota2).We first collected data of all games with drafts information played between August 2011 and February 2015 tracked on datdota.com. The population of games belongs to tournaments with over $1000 prize pool and feature professional teams. Focusing on professional games with clear monetary benefits allow us to ensure that teams competing in the matches have clear motivator to succeed. The primary dataset from datdota.com tracks the in-game names used by players and can change with time. We extended the dataset by uniquely identifying the players for each match after any possible name change. We further added the nationality of the uniquely identified players with information from the other major gaming sites (i.e. dota2.gamepedia.com, gosumgamers.com, wiki.teamliquid.net/dota2) that track key biographic information of professional players. The description of the variables and the key descriptive statistics of the variables used in our empirical model are exhibited in Table 1 and Table 2 respectively.

Table 10: Description of Variables used in Empirical Model

Variable Name	Description	Measurement
Team Avg Task Exp	Team Average Task Experience	The average number of competitive games played by each individual of the team as of the day the game was played
Opp Avg Task Exp	Opponent's Team Average Task Experience	The average number of competitive games played by each individual of the opponent's team as of the day the game was played

Team Task Exp Div	Team Task Experience Diversity	The standard deviation of the number of competitive games played by each member of the team as of the day the game was played
Opp. Task Exp Div	Opponent's Team Task Experience Diversity	The standard deviation of the number of competitive games played by each member of the opponent's team as of the day the game was played
Team Task Exp Inter	Interaction variable between Team Average Task Experience and Team Task Experience Diversity	The multiplication between the value of the variables Team Average Task Experience and Team Task Experience Diversity
Opp Task Exp Inter	Interaction variable between Opponent's Average Task Experience and Opponent's Task Experience Diversity	The multiplication between the value of the variables Opponent's Team Average Task Experience and Opponent's Team Task Experience Diversity
Uncertainty	Environmental Uncertainty	Difference of date of nearest prior patch and date of match. This is a negative integer. E.g. 1 day means match is played one day after patch, -10 day means match is played 10 days after patch
Team Nationality	Team Nationality Diversity	Number of unique nationalities in the team
Opp Nationality	Opponent Nationality Diversity	Number of unique nationalities in the opponent's team
Team Nationality X Team Avg Task Exp	Interaction variable between Team Nationality and Average Team Task Experience	The multiplication between the value of the variables Team Nationality and Team Average Task Experience
Opp Nationality X Opp Avg Task Exp	Interaction variable between Opponent's Team Nationality and Average Opponent's Team Task Experience	The multiplication between the value of the variables Opponent's Team Nationality and Opponent's Team Average Task Experience
Online	If the game is played through the internet or at a specific location	1: internet, 0: specific location

Time	Time taken for the game to end	Measured in minutes and seconds
Team First Pick	Team makes the first pick during the draft	1: if team picks first, 0: opponent team picks first
Constant	constant	
Team Win	Team wins the match	1: team wins, 0: opponent team wins

Table 11: Descriptive Statistics of Tables used in Empirical Model

Variable Name	Mean	Median	Std. Dev	Min	Max
Team Win	0.50784	1	0.49996	0	1
Team Task Exp Div	201.0024	152.2	180.7328	0	795.4
Opp. Task Exp Div	206.0277	157	184.5523	0	794.4
Team Nationality	74.31676	41.6329	81.34225	0	424.9337
Opp Nationality	73.91559	41.5307	81.06514	0	424.9337
Team Task Exp Inter	1.86181	2	1.05233	1	5
Opp Task Exp Inter	1.86787	2	1.05694	1	5
Team Task Exp Inter	22869	6628.51	36183.93	0	242181.6
Opp Task Exp Inter	23027.77	6875.82	35552.31	0	242590.1
Team Nationality X Team Avg Task Exp	481.4975	243.6	607.9839	0	3888
Opp Nationality X Opp Avg Task Exp	499.3447	252.6	632.616	0	3883
Uncertainty	-42.80097	-32	35.28774	-147	-1
Online	0.79628	1	0.40278	0	1
Time	36.29901	34.93	12.47546	5.2	200.57
Team First Pick	0.58815	1	0.49219	0	1

A total of 15,953 observations was collected from datdota.com. Each observation represents a match. 2,180 data points were excluded because of missing information leaving 13,773 observations in the dataset. The excluded data points were driven primarily by the lack of data and tracking in the earlier stages of the development of the game. As the dataset covers the entire population of professional matches, we are able to avoid sample selection bias. From the available information found in the abovementioned sites, 651 players with 48 nationalities were uniquely identified.

Team Nationality Diversity is computed from the extended information as the number of distinct nationalities found in a team.

As the study is scoped to the professional scene with clear monetary incentive, and constrained by limitation of the dataset, we start counting the experience of the players from the day they appear on the professional scene. Individual task experience is proxy by the number of professional games previously played by the player. Past research has used a self-reported measure of the number of times performing a task (Lance et al., 1989) for task experience. As we have the exact number in the context, motivating our measure of task experience as the objective count will serve to provide getter accuracy. Team average job tenure and team average task experience is calculated by averaging the individual job tenure and individual task experience of each team member respectively. Following the literature of team diversity (Bell et al., 2010; Joshi & Roh, 2009), we use standard deviation of the continuous variable to determine diversity. Team task experience diversity is therefore standard deviation of the individual task experience for a team.

In addition, patch information was also gathered from the above-mentioned site. Each patch update was first evaluated for its importance in introducing uncertainty into the environment. We differentiated between bug fix patches and balance patches which changes the attributes of in-game characters and items. Balance patches were determined to introduce a significant level of uncertainty in game-play. For the period of August 2011 to February 2015, 17 bug fix patches and 31 balance patches were introduced. Environmental Uncertainty was calculated as the negative number of days since the implementation of the previous nearest patch. The largest value for Environmental Uncertainty is -1, on days at which a new patch is implemented. Environmental Uncertainty will decrease with time as players spend more time playing

on a new patch. The influence is captured when we decrease its value by 1 for each day that passed.

Controls

We used two types of controls to establish a rigorous basis for our empirical results. The first type of controls are match-level control variables which account for possible variations across matches. The match-level control variables consist of Team first pick, online, time and environmental uncertainty. Team first pick allows us to control for possible advantages of being able to pick first during the drafting phrase and online allows us to control for the effects of differences in geological distance between team mates during game play. Environmental uncertainty allows us to control for the overall effects of variable as we study its moderating effect on other variables.

The other type of control variables that are used to control for the influence of the opposing team. In a match, the team competes with an opposing team and it is inevitable that the characteristics of the opposing team will influence the result of the match. It is hence important for us to control for the opposing teams' attributes for the variables that are studied in the paper.

Models and Methods

The performance of a team can be represented as a function of the characteristics of the team, *X*, the characteristics of its opponent, *Z*, during the game as well as other environmental factors, *W*, influencing the game, *j*.

$$P_j = f(X_j, Z_j, W_j) \qquad \forall\, j \tag{1}$$

To test our hypotheses, we present (1) as a linear model using match level data between two competing teams and the baseline equation of the model is represented by:

$$Y_j = \beta X_j + \gamma Z_j + \theta W_j + \varepsilon_j \quad (2)$$

where *Y* is the dependent variable which is Team wins (as a proxy for performance). β and γ represents the constant for respective variables, ε represents the game-level random error.

A team's *prior* experience with a specific opposing team might affect the outcome of match. Experience against a particular team allows opportunities of learning and preparation that is unique to the specific opponent. In-addition, the distinct knowledge that exist between a unique team-opponent pairing creates a creates an influence that is exclusive to the team-opponent pairing. In-order to control for the effect of prior game experiences against a particular opponent, we build a panel data with the team's name and opposing team's name as the unique identifier, *i*. Hence, the "wins" of the particular team is now represented as:

$$Y_{ij} = \beta X_{ij} + \gamma Z_{ij} + \theta W_j + \varepsilon_{ij} + \nu_i \quad (3)$$

where *i* is the unique match pair of team and the opponent, and ν_i is idiosyncratic experience the team has with regards to this particular opponent.

Given that Y_{ij} is a binary outcome (win or lose – draws are not possible in this game), we used a logit regression to estimate the model. We ran a longitudinal logit regression with random effects on the panel data created. We use random effects because some variables specify in X, Z and W were invariant across game pairs.

For this specification, we ran three sets of analyses: one focusing on the effects of diversity in task experience (thereafter Model 1), one focusing with a focus on diversity effects of Nationality (thereafter Model 2), and once with all the variables included in model (thereafter Model 3). We performed three sets of analysis as the

variables used in the complete model (Model 3) has marginal multicollinearity concerns.

Table 12: VIF

Model	Max VIF
Model 1	7.60
Model 2	9.13
Model 3	9.73

The results of the analysis justify that all three models are similar in outcomes. We presented all the 3 models together for completeness and comparison.

RESULTS

We discuss the results of our analysis in this section. We first discuss the impact related to diversity in team task experience, followed by diversity in nationality and then moderating effects of team task experience on the earlier variables. We then proceed on to discuss the robustness of our empirical model under the longitudinal logit regression with random effects. Below are the results of analysis.

Table 13: Logit with Random Effects Estimators

Dependent Var	**Logit with Random Effects Estimators**					
	Model 1		**Model 2**		**Model 3**	
	Odds Ratio	**Std. Err.**	**Odds Ratio**	**Std. Err.**	**Odds Ratio**	**Std. Err.**
Team Avg Task Exp	4.84314***	0.33878	4.99214***	0.50923	5.49915***	0.62868
Opp Avg Task Exp	0.2234***	0.01526	0.18948***	0.01906	0.17849***	0.02008
Team Task Exp Div	3.70838***	0.75915			1.78859**	0.39387
Opp. Task Exp Div	0.21085***	0.0439			0.40268***	0.08998
Team Task Exp Inter	0.29615***	0.05908			0.54932**	0.11497
Opp Task Exp Inter	3.82652***	0.785			2.27769***	0.48931
Team Nationality			1.27529***	0.04659	1.2602***	0.04688
Opp Nationality			0.80326***	0.02971	0.82137***	0.03093
Team Nationality X Team Avg Task Exp			0.82532***	0.03122	0.83436***	0.03253
Opp Nationality X Opp Avg Task Exp			1.23517***	0.04568	1.20184***	0.04596
Uncertainty	1.00043	0.00054	1.00035	0.00057	1.00032	0.00058
Online	1.0249	0.05045	1.01632	0.05217	1.02206	0.05286
Time	0.98642***	0.00153	0.98751***	0.00161	0.98761***	0.00161
Team First Pick	1.06885	0.04154	1.062	0.04387	1.05812	0.04385
Constant	1.63377***	0.1462	1.55579***	0.18882	1.56253***	0.19265
sigma_u	0.48058	0.04723	0.47386	0.04771	0.472	0.04783
rho	0.0656	0.01205	0.06389	0.01204	0.06342	0.01204
Wald chi^2	953.7		805.4		824.96	
AIC	17599.54		15646.64		15647.64	
BIC	17689.79		15735.43		15736.43	
Signif.: *** = p < 0.001, ** = p < 0.01, * = p < 0.5						

Online	Uncertainty	Opp Nationality X Opp Avg Task Exp	Team Nationality X Team	Opp Nationality	Team Nationality	Opp Task Exp Inter	Team Task Exp Inter	Opp. Task Exp Div	Team Task Exp Div	Opp Avg Task Exp	Team Avg Task Exp	
0.0034	-0.0019	-0.1098	0.1113	-0.0884	0.0681	-0.0705	0.0794	-0.0694	0.0433	-0.1442	0.1347	Dependent Var
-0.1784	-0.0091	0.3777	0.8275	0.3739	0.6869	0.2083	0.4113	0.3159	0.4949	0.4675	1	Team Avg Task
-0.1652	0.0023	0.829	0.3802	0.675	0.3779	0.4334	0.2047	0.4722	0.3268	1		Opp Avg Task Exp
-0.0213	0.0274	0.2573	0.3266	0.3726	0.8873	0.1269	0.1526	0.3495	1			Team Task Exp Div
-0.0057	0.018	0.3049	0.2561	0.8863	0.3677	0.15	0.1217	1				Opp. Task Exp
-0.0555	-0.0207	0.1839	0.7477	0.1514	0.2303	0.1579	1					Team Avg Task
-0.0459	-0.02	0.7643	0.1885	0.2418	0.156	1						Opp Avg Task Exp
-0.0752	0.0249	0.3079	0.5169	0.4157	1							Team Nationality
-0.061	0.0238	0.5083	0.3096	1								Opp Nationality
-0.1432	-0.0205	0.3143	1									Team Nationality X
-0.1319	-0.0082	1										Opp Nationality X Opp Avg
0.0095	1											Uncertainty
1												Online
												Time

Table 14: Correlation Table

Time	-0.0756	0.0487	0.0648	0.0891	0.0849	0.0138	0.029	0.0943	0.0906	0.0399	0.0481	0.0571	-0.0556	1
Team First Pick	0.014	-0.0872	-0.0848	-0.1147	-0.0958	-0.0262	0.0017	-0.1045	-0.0872	-0.0608	-0.042	0.0119	-0.0256	-0.0349

Diversity in Team Task Experience

Table 13 presents the results of the analysis. Model 1 and 3 includes the variable team task experience diversity. The interpretation of the odds ratio for the Team task experience diversity is as follows: model 1 shows that an increase of 1 game of task experience in standard deviation of a team increases the chance of the team winning by 1.0036 times. The small effect size should not be overly interpreted as odds ratio is an unstandardized effect size statistic. The analysis shows that Team Task Experience Diversity increases the probability of the team winning (model 1: $p < 0.001$, model 3: $p < 0.01$). The analysis also shows that the odds ratio is smaller than one for the task experience diversity of the opposing team. This means that the factor of the team winning decreases by the multiple of the ratio when the task experience diversity of the opposing team increases by one unit. There is no contradiction between the results of analysis for the variable of focal team and the opposing team. Therefore, there is strong evidence in support of Hypothesis 1a.

Diversity in Team Nationality

Strong support was also found for Hypothesis 1b. Both Logit models that included the team nationality diversity variables is found to be greater than one with $p < 0.001$. The odds ratio the opposing team's nationality diversity is also found to be smaller than one for the two models. This is revealed by the odds ratio of the 2 variables, the probability of a team winning increases with increase in team nationality diversity and

decrease of team nationality diversity. Similar to the earlier discussion on effect size for odds ratio, the smaller odds ratio for team nationality diversity (1.27529 in model 2) is not reflective of the strength of the relationship between team nationality diversity and team performance.

Average Team Task Experience

All three models in the analysis were consistent on the interpretation of the average team task experience and opponent's average team task experience. The average team task experience is constantly greater than 1 and that of the opposing team is smaller than one. This means that average team task experience is found to be improve the chance of the team winning the match. Evidence was therefore found in strong support of hypothesis 2 ($p < 0.001$).

Moderating effects of Average Team Task Experience

The interaction variable between average team task experience and team task experience diversity has an odd ratio below 1 (model 1, 3). An increase in average team task experience reduces the effect of team task experience diversity and has a negative impact on the chances of winning a game. The relationship is found to hold at a 0.001 significant level in model 1 and at a 0.01 significant level in model 3 suggesting a strong evidence in support of hypothesis 3a.

Similarly, for the variable "Team Nationality Diversity x Average Team Task Experience", the odds ratio is found to be below 1 (model 2, 3). An increase in average team task experience also weakens the effect of team nationality diversity on team performance. The relationship is found to be significant at 0.001 level for both models 2 and 3 reflecting a strong support for hypothesis 3b. For both hypothesis 3a and 3b, the odds ratio for the respective variable for the opposing team is greater than

one and the relationships are found to be significant at 0.001 level. This provides even further support for hypothesis 3a and 3b.

DISCUSSION

We empirically studied the effects of task experience on teams in a natural setting motivated by clear monetary incentive. Serval key implications can be drawn from the study. Firstly, team task experience diversity was found to be positively related to team performance. To the best of our knowledge, this is the first endeavour in literature to discuss this relationship. The investigation of team task experience diversity contributes to the team diversity literature which has ceased studying the implication of experience at the team, job and organization level. The proponents of diversity has primarily evoked the Cognitive-Diversity Hypothesis (Cox & Blake, 1991) which focuses on the benefits of a greater set of unique cognitive resources on team performance. Understanding the implication of diversity of team task experience on team performance further provides insights on the effects of diversity of quality of cognitive resources on team performance. Unlike the unique quantity of cognitive resources possessed by an individual, the quality of cognitive resource is highly perceptive by others as expertise on the team task.

Secondly, the study also reaffirms the positive relationship between team nationality diversity and team performance. For this piece of research, the study of the variable is aims to contrast between the effects of quality and quantity of unique cognitive resources on team's performance. This accentuates the theoretical gap that is filled by the investigation into diversity of team task experience diversity.

Lastly, we also examined the moderating effects of team task experience on the earlier 2 mentioned variables. Earlier research has already established the positive relationship

between average team task experience and team performance (Gino et al., 2010). The relationship is reaffirmed in the study. In addition, demonstrate that effects of diversity in team task experience and team nationality on team performance is negatively moderated by average team task experience. The moderating effects of team task experience compliments earlier team task moderators investigated by research (e.g. team task routines, team task complexity).

In conclusion, the findings of study show that task experience has a complex relationship with team performance. Diversity in task experience, unlike other diversity variables, is a perceptible attribute that emphasises different levels of expertise between team members on a team task. We further investigated the moderating effects of average task experience on the relationship between diversity variable and team performance. Our findings suggest that the lack of task experience, or abundance of it, has great implication on how various diversity variables affects team outcomes. This has great practical implications as it provides insight on another important factor that has to be considered when forming teams. While forming a team with high average team task experience is always desirable, it might not be practical in the real world. It is important to consider the distribution of team task experience when organizations formulate multiple work teams.

IMPLICATIONS

Implication for Future Research

Future research regarding the effects of team task experience diversity on other team outcome variables with other diversity variables will greatly enhance our understanding of the effects of team task experience diversity on team performance. Although we have established the main effects of team task experience diversity on team performance, more cannot be done to investigate the team processes that results

in our observation. Also, as we have embedded our study in a unique team context. The context studied is a natural setting, with intact teams that are motivated by clear monetary incentives, but there could still be differences between a gaming team task and other generic work task. The generalizability of the findings in the paper towards other type of team task could be questionable. Although we expect minimal differences between the observations made in the study and other teams working on complex task in natural settings, we believe contributions could still be made studying the variable in traditional organizational settings.

Current research has formulated frameworks to differentiate demographic variables in diversity literature. Two of the more prominent frameworks include differentiating between task-related demographic variables and non task-related demographic variables (Pelled, 1996; Pelled et al., 1999), and also surface- and deep-level diversity (Harrison, Price, & Bell, 1998). Although there are merits to both frameworks, the effects of diversity on team outcomes has remained inconsistence under the respective theoretical lens. Our insights points to new dimension that could be considered when theorising on diversity variables. The findings suggest that perceived difference in expertise on a team task (task-related) helps to promote collaboration in a team. Investigating the differences between perceptible (surface-level) task-related demographic variables and deep-level task-related demographic variables could becoming interesting.

CONCLUSION

There are abundance of research on the effects of diversity on team's performance. In this study, we aim to contribute to literature by investigating the effects of task experience which has been largely overlooked in team diversity literature. We

empirically tested the implications of diversity in team task experience, diversity in team nationality, average team task experience and moderating effects of average team task experience in a natural setting. We found that the relationship between Task Experience and Team Performance more complex than suggested by earlier research. We found that although both higher Team Average Task Experience and higher Team Task Experience Diversity improves Team Performance, Team Average Task Experience weakens the relationship between Team Task Experience Diversity and Team Performance. We found a similar moderating effect of team average task experience on the relationship between nationality diversity and team performance. Given the widespread use of heterogenous work teams in organizations, our study also provides practitioners with further insights on the implication of team task experience on team performances. This will complement the research findings which has focused on team, job, and organizational experience. Our findings suggest that task experience is an important consideration during team forming. With limitations of human resources, it is important to consider the distribution of task experience across teams when multiple teams are involved.

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