Optimizing the Psychological Benefits of Choice:

Information Transparency & Heuristic Use in Game Environments

James J. Cummings

Stanford University

Travis Ross

Indiana University

Abstract

This paper suggests that the paradox of choice can be resolved in game environments by promoting heuristics-based decision-making, thereby maintaining player freedom while also avoiding the potential negative consequences of excessive deliberation. To do this, the informational cues relevant to such decisions must be made transparent, allowing players to employ fast and frugal tools from the brain's adaptive toolbox to make the same optimal choices that they might otherwise make after extended deliberation. Developers can design for such transparency not only by creating choice experiences in which options can be assessed and compared through clear metrics and attributes, but also by designing social systems in which the choices and successes of others can be easily identified and used for informing one's own future decisions.

Keywords: games, design, heuristics, ecological rationality, decision-making, paradox of choice.

Optimizing the Psychological Benefits of Choice:
Information Transparency & Heuristic Use in Game Environments

Introduction: The Paradox of Choice

People are generally thought to prefer having a number of options available when making a choice. When presented with options, we are permitted to choose for ourselves, in light of our own personal tastes and needs. This conventional wisdom that choice is preferable is corroborated by the sheer amount of options characteristic in modern consumerism – everyday actions ranging from selecting peanut butter to customizing one's new laptop computer are often filled with a menagerie of choice options. Self-determination theory suggests that this preference for choice is tied to an adaptive desire for control over one's own conditions (Deci, 1981; Deci & Ryan, 1985; Ryan & Deci, 2000; Ryan, Rigby, & Przybylski, 2006). In being able to choose between multiple alternatives, we are permitted to exercise and validate a sense of individual freedom and autonomy over our environment. Further, such perceived autonomy is found to be intrinsically motivating, thereby leading individuals to prefer conditions in which they are able to determine their own outcomes (Deci, 1975; Deci & Ryan, 1985). That is, we enjoy having a say in what happens to us, and therefore we enjoy having options.

However, while research in both the laboratory and the real world has found that individuals enjoy the decision-making process more when they are presented with a greater number of choices, it has also revealed that having too many choices can lead to certain negative consequences (Deci & Ryan, 1985; Iyengar & Lepper, 2000; Schwartz, 2005; Zuckerman, Porac, Lathin, & Deci, 1978). First, there appears to be a threshold at which a wide range of choices can become paralyzing to the decision maker. At a certain point the number of options becomes large enough that a decision-maker simply has difficulty differentiating the preferred option.

Second, an abundance of choice can lead to regret and frustration due to future uncertainty of whether the individual has made the correct choice. In other words, though there is a preference for having the freedom of choice, taken too far this freedom can result in paralysis or dissatisfaction.

This predicament – a desire for freedom, autonomy, and self-determination that in excess can lead to negative outcomes – has been termed the "paradox of choice" (Schwartz, 2005). Researchers have identified numerous instances of the paradox of choice, with perhaps the best known examples occurring in a study by Iyengar & Lepper (2000). In their study the researchers examined the influence that number of choices had on three different decision-making situations: deciding on a topic for an extra credit paper (30 choices versus 6 choices), purchasing jam in a grocery store (24 versus 6), and choosing chocolate versus money as a reward for participation in an experiment (30 versus 6). What they found was that the participants seemed to be more attracted to the high choice conditions. However, participants in the limited choice condition were significantly more likely to actually follow through with a purchasing jam (+27%), completing the extra credit (+14%), and choosing chocolate instead of money (+36%) compared to their peers in the extended choice condition. These results, and others in marketing research and psychology, provide a startling testimony to how too many choices can be a problem for both producers and consumers (Iyengar, Wells, & Schwartz, 2006; Schwartz, 2005; Shah & Wolford, 2007). Yet, somewhat surprisingly, individuals still seem to demand more choices in their day to day lives: a quick glance around the modern grocery store, athletics store, or retail chain shows an abundance of choices for the potential consumer. Both lab research and commercial trends suggest that individuals, particularly those in Western societies, can't help but succumb to the apparent tyranny of freedom (Schwartz, 2000).

The Adaptive Toolbox: How Heuristics Shape the Decision-making Process

With the increasing number of choices available in modern decision-making environments, and consumers only continuing to demand more options, how can we hope to avoid the paradox of choice? One solution for overcoming the tyranny of too much choice lies in how the mind of the decision-maker processes information about the options at hand.

Beyond choosing at random, individuals generally have two options for dealing with the paradox of choice. The first is to choose based on a process of rational deliberation, that is, by devising what the best choice is by systematically weighing each against one another. However, when an individual with a limited amount of experience in a given decision-making environment is provided with a large number of choices, or the attributes of those choices don't sufficiently discriminate their relative values, the strategy of rational deliberation can lead to paralysis and frustration. An individual who wishes to make an optimal choice using rational deliberation must be willing to invest the time and energy required for gathering all the pertinent choice information and then sorting through that information in order to ascertain the best option.

The other option for individuals who wish to make quick, yet accurate decisions in an extensive choice environment is to rely on mental heuristics (Gigerenzer & Goldstein, 1996; Gigerenzer & Todd, 1999; Goldstein & Gigerenzer, 2002). Consider that the human brain is the result of an adaptive, evolutionary process, and thereby shaped by the selective environmental pressures experienced by our ancestors. Unlike the majority of decisions made today, those made by ancestral brains often had direct consequences for survival. Under these conditions, decisions needed to be based on accurate information (there may be little room for error), as well as be made quickly (responding too slowly to certain environmental situations could result in losses ranging from one's meal to one's life). These joint and somewhat conflicting pressures of

accuracy and speed are thought to have resulted in the evolution of an adaptive toolbox, consisting of a variety of simple heuristics for decision-making – mental mechanisms that rely upon partial information rather than complete information to ascertain a preferred course of action (Gigerenzer & Selten, 2001). In lieu of extensive deliberation, heuristics allowed ancestral minds to apply simple evolutionarily-selected rules of thumb or criterion to the most salient environmental and social cues. As an adaptive strategy, heuristics allowed individuals to decide between options in a quick and reasonably informed manner. Of course, the trade-off for this speed was the sacrifice of optimal decisions for "good enough" decisions – those that were not necessarily the best of all alternatives, but beneficial enough to allow the individual to survive and reproduce.

There are a number of heuristics available and they generally function by simplifying choices in two ways: fast, frugal searches and information reduction (Todd, 2007). For example, the *take the best heuristic* is a search heuristic that balances computational expenses with accuracy by discriminating on the single attribute that is perceived as most important. Whichever choice is best for that attribute is then chosen. If the first attribute doesn't discriminate, then the comparison continues with each additional attribute in order of perceived importance until an attribute discriminates between the choices (Gigerenzer & Goldstein, 1996). Another example of this type of search heuristic is the *tallying* heuristic, which quickly compares the attributes of each choice and selects the one with the largest sum of favorable attributes (Dawes, 1979). Conversely, rather than helping a decision-maker search, other heuristics may provide short-cuts to decision-making by limiting the amount of information to be gathered regarding different options. The *recognition heuristic* and the *default heuristic* both tremendously limit the information an individual must gather. The first evaluates both options,

and if one is recognized as familiar it is chosen. . The second simply takes the default option if one exists (Goldstein & Gigerenzer, 2002; Johnson & Goldstein, 2003). Other heuristics that limit the amount of information required to make a decision are social heuristics such as *copy the majority* or *copy the successful* (Boyd & Richerson, 2005). Both are successful because instead of having to weigh a series of complex choices, an individual can instead copy the decisions and behavior of others.

Heuristics such as these allowed ancestral brains to make decisions quickly and without full information. Might a reliance on these inherited mechanisms similarly allow modern day decision-makers to bypass extensive deliberation when faced with a bounty of choices? One perspective on heuristics would suggest not, noting that these cognitive short-cuts, when used today, often results in classically irrational behavior. The paradox of choice, anchoring, altruism, and recognition biases might all be explained as byproducts of mental short-cuts that periodically fail in modern environments (Kahneman, Slovic, & Tversky, 1982; Piattelli-Palmarini, 1996; Todd, 2007; Trivers, 1971; Tversky & Kahneman, 1986).

However, it has also been noted that heuristics can be incredibly successful decision-making tools, even sometimes outperforming more complex statistical methods of weighing and selecting choices (Gigerenzer, 2008; Gigerenzer & Selten, 2001). This perspective on heuristics suggests that relying on them when making decisions is not uniformly rational or irrational, but rather, dependent upon how information is structured in the environment. For example, it was rational for ancestral brains to rely on heuristics, as such mechanisms helped them to quickly use incomplete information (only specific cues or attributes) to still make sensible, “good enough” decisions. Todd (2000) describes this reliance on specially-tailored cognitive short-cuts as having been “ecologically rational” at the time – that is, considering the informational

allowances and restrictions of the ancestral environment, heuristics made for the most rational decision-making strategies, permitting relatively large payoffs and a greater chance of survival than extended deliberation.

Therefore, it stands to reason that heuristics-based decision-making may indeed serve as an escape from the tyranny of choice in modern environments, so long as such an approach is ecologically rational. As noted above, the use of heuristics can lead to marked success in some modern choice environments (Gigerenzer, 2008), but can be quite irrational (even predictably so (Ariely, 2008)) in others. And again, the relative ecological rationality of a given decision-making strategy – heuristic or deliberation – is dependent upon how the informational environment is structured. If consumers and other decision-makers can distinguish between good and poor alternatives using only particular attributes or available cues then heuristics may be rational, and the barrage of choice welcome, as the amount of information one must process is minimized.

Modern Video Games as Choice Environments: Virtual Choice and Choice Tyranny

Todd (2007) suggests that more than ever humans find themselves in environments where there is too much information to be fully attended to and weighted, as modern technology permits a form of information overload that simply exceeds our cognitive capacity for proper deliberation. Lenton, Fasolo, and Todd (2010) investigated one such modern choice environment in their examination of online dating. The authors note that the patrons of dating websites generally prefer having more potential partners to choose from, but this preference for more options, each with numerous attributes to be weighted, leads to choice overload and demonstrates that the paradox of choice exists in the virtual choice environment. Lenton et al. suggest that to cope with this overload, site users will employ simplifying heuristics; however, as

the site users' expectations about the abundance of choices is poorly calibrated to the actual benefits, this reliance on heuristics can actually be detrimental to choice outcomes when selecting a date. In other words, heuristics-use is not ecologically rational in that particular informational environment.

Another choice venue that has become increasingly popular with recent advances in technology is that of virtual game environments. Games, even offline, non-digital varieties, can easily be understood as constructed decision-making environments – for example, in chess, players take turns deliberating between a number of available options in order to achieve a specific goal state. Modern video games also share this trait, however, the choices to be found within them are often incorporated into a larger play experience shaped by narrative context, social interaction (competitive battles, cooperative goals), and physical ability (hand-eye coordination, dexterity, reaction time). With the rise of computers and the Internet, large scale games and virtual worlds have grown complex enough to cater to players who possess a variety of motivations beyond the rational deliberation and optimization of strategies. Players play to win, but they also want to have a fun experience in the process, and they accomplish this in a number of ways (Bartle, 1996; Yee, 2006).

Choice in Games

In order to understand how research on choice can be applied to games it seems to make sense to attempt to address the following question: Do the choice environments found in modern video games lend themselves to the heuristics inherent to players within the adaptive toolbox of the mind? That is, is it ecologically rational for players to employ heuristics when dealing with the informational structure of their game environments? In order to answer these questions, it'd be helpful to first consider the nature of choice in these spaces.

Games Include Player Customization.

Modern games, especially virtual worlds, feature an abundance of choice. Players can follow non-linear storylines and progress through various "physical" areas of the game world, can choose a wide variety of strategies for accomplishing goals in the world, and have a wide array of options for customizing the appearance, possessions, and abilities of their onscreen avatar. These elements have long been popular in games yet recent anecdotal evidence suggests that choice and customization across genres and forms of gameplay has become extremely important to players. One example of increased choice that has recently invaded almost all modern games is the addition of role-playing game (RPG) style customization options. An examination of games that feature RPG elements provides telling evidence that players desire choice and customization: puzzle games (*Puzzle Quest*, *Puzzle Pirates*, *Warlords Online*, etc.), action games (*Monster Hunter*, *Mass Effect*, *Diablo*, etc.), massively multiplayer online [or MMO] games (*World of Warcraft*, *EVE*, *Everquest*, *Lord of the Rings Online*, etc.), first-person shooters (*Modern Warfare*, *Borderlands*, *Bioshock*, *Fallout 3*, *Stalker*, *Battlefield Heroes*, etc.), social network games (*Farmville*, *Mafia Wars*, *Social City*, etc.) and even racing games (*Forza Motorsport*, *Gran Turismo*, etc.), all feature expansive choice and customization options. This commercial trend for increasing the amount of choice in video game environments likely reflects player preferences for more choice and options, which has been established in recent empirical studies (Bailey, Wise, & Bolls, 2009; Cordova & Lepper, 1996; Ryan, et al., 2006).

Yet, not all choice is designed equally. Some choices lead to large discrepancies in the abilities and potential virtual actions of player characters, while others choices are relatively trivial in terms of gameplay utility or social standing. For instance, in massively multiplayer online games such as the popular *World of Warcraft*, some choices – including the selection of

character class and race, the allocation of limited points toward alternative abilities and talents, and the equipment of one magical item versus another – can have a large effect on player performance and even the social desirability of a player for group play activities, while other choices – for example, the type of animal mount or avatar hair color – might have a negligible effect on performance or social standing.

Game Choices Can Be Persistent… And Costly.

In addition to considering ramifications for performance and sociality when selecting one choice over another, players making decisions in modern games are also well served to consider the cost of switching from one particular choice to an alternative option. Historically, choices in video games were often trivial or of little consequence, as game goals could be often be achieved by repeated trial and error. For example, a player may be permitted to make an initial attempt at the goal (e.g., make it to the finish line first or reduce an opponent's health points to zero), receive feedback on his or her performance, and then hone a winning strategy through future trials until the goal is achieved. In such games, the reset option erases the negative repercussions of poor in-game choices – failure is temporary, and even designed for as part of the enjoyment of gameplay. However, a recent trend in video games – persistence – has diminished the relative triviality of a player's decisions. In persistent game environments (typically MMOs, but now found across an expanding assortment of game types), a player's choices are saved and persist over time, having real consequences for future in-game activities, including which future choices may or may not be made available. In these environments, game decisions become less trivial, as they can only be re-made by incurring a specific switching cost. For instance, in *World of Warcraft* a player character has a finite amount of talent points to distribute across alternate choices; the manner in which these points are allocated have very strong implications for both

the character's in-game abilities as well as how socially desirable the character is for cooperative social gameplay. If after allocating the points the player feels that he or she would have been better off with an alternate specification (or "spec") of talents, the only way to re-assign the points is to pay a fee with the game's currency. Moreover, this switching cost increases with each re-trial (re-spec). As such, player's that make poor decisions when initially assigning talents points can lose a significant amount of in-game money. Trial and error is an expensive strategy.

Social Choices in Virtual Spaces Can Have Real Consequences.

Finally, as noted above, many modern games strongly incorporate a social element into gameplay. Though multi-player games are not themselves anything new, recent advances in computing and the web have allowed new levels of richness in such interaction. In both MMOs and other traditional genres that have recently moved into online play (first-person shooters, sports games), interactions between players are often guided by socially sanctioned rules. Such emergent guidelines may structure player behaviors and choices just as much as those rules hardwired into the game's code. For example, in order to organize group decisions about sharing rewards gained through collaborative efforts, players have developed the phenomenon of dragon kill points (DKP) as a semi-currency (Castronova & Fairfield, 2007; Malone, 2009). Though not all as formal as explicit monetization, it is clear to most players that there exist commonly shared rules of etiquette for interacting with other real life players in online spaces, and these rules can be followed or flouted. Moreover, as there are real people behind the avatars, the choices players make when cooperating and competing with others can have very real social consequences, ranging from the receipt of in-game gifts to marginalization and ostracism – consequences that in turn affect the future options permitted to a player in these social environments.

The Tyranny of Choice in Game Environments – Information Overload and its Effect on Enjoyment

In discussing the types of choices players face, it is apparent that the virtual environments of games, much like real world environments, contain choices that can be either trivial or serious, with real repercussions for success, enjoyment, and future play. Modern games, which increasingly incorporate customization, persistence, and social interaction, are abound with situations in which players must make choices that will differentially affect in-game outcomes and a player's ability to successfully perform.

However, it may be difficult for game players to negotiate different choice options due to the fact that they are often found in what previous scholars have termed "unfriendly choice environments" (Fasolo, et al., 2007; Shanteau & Thomas, 2000). In these environments, the information used to evaluate and compare alternative options does not always clearly point to one decisive optimal strategy. Take for example the case of a player trying to select from two alternate pieces of virtual armor. One piece of armor may increase the player character's armor rating by 300 points and its stamina score by 4. The second piece may increase the armor rating by 200 and its stamina by 6. This is a case of conflict among product attributes, in which one alternative is not uniformly superior to the other, and thus the player may experience a certain difficulty in ascertaining the correct choice. Of course, it may be the case that the relevant attributes for the comparison are unequally important – perhaps stamina score is decisively more important than armor rating. In such a case the second piece of armor is clearly the correct choice. However, such certainty about the relative equality of attributes is often less than immediately intuitive to most players and may require a great deal of time and experience in a game environment to be understood. Further, the relative equality of attributes may change in

light of the vast and complex nature of many modern game environments – it could be the case that one's stamina score is of greater value when combating undead zombies but that armor rating is of relatively higher worth when faced with the piercing spears of barbarian warlords. Under such circumstances, how might a player plan accordingly when having to choose between the two pieces of armor?

Such a choice dilemma is common to players seeking to succeed in game environments, though in most cases individuals will in the end be making numerous comparisons between a much larger number of potential options. For example, in *World of Warcraft* players are currently faced with an environment filled with 19,363 types of armor, 718 trade good items, between 150-250 different abilities per player class, another 150-250 different talents per class, 263 different animal mounts, and 1,999 types of consumable (finite use) items (http://www.wowhead.com). In turn, many of these different options are compared on a large number of attribute ratings – bonuses to one's armor rating and stamina, of course, but also bonuses to other character attributes like strength and spirit, character traits like mana regeneration rate or critical strike rating, and all manner of less-than-readily-quantifiable added effects, such as additional damage against orcs or ability to breath under water for 10 minutes. Such attributes, both in their number and in their often incomparable consequences, only exasperate the process of deliberating over and selecting from alternatives (Fasolo, et al., 2007). Moreover, the player analysis of these options is further exasperated by the fact that the virtual world does not have the same physical constraints as does the real world – as such, designers can alter the types of choices and their respective attribute rankings with just a few lines of code, as is the case with patch updates (which, for example, occur weekly for *World of Warcraft*).

To gather all this information, weight and analyze options, and then choose the optimal strategy is nothing less than a Herculean cognitive task. What we see here then in modern games is the tyranny of choice – a situation where to take in and consider all information about all possible choices for every in-game decision would likely lead to severe negative consequences. As with choice and information overload in the real world, players facing such a choice environment in the virtual world would be required to perform extensive deliberation and thereby find themselves experiencing a severe time delay whenever faced with making a decision. The turn-around time between environmental presentation of options and player response would be enormous as a player seeking to maximize his potential payoff would require ample time to calculate relative benefits. Gameplay could come to a nearly paralyzed state, devoid of much of the immediate feedback loops between player and game that characterize the more physiologically engaging components of gameplay (Lim & Reeves, 2009; Sherry, 2006). Coupled with this would be other negative consequences common to individuals faced with choice overload in the real world. Specifically, when faced with such a cognitive challenge, many players may experience frustration (due to the sheer amount of work to be done) and still only end up dissatisfied (due to the lack of certainty that their choice was the correct one). Additionally, such negative affective consequences of choice overload are more common for individuals that seek to maximize their choices, which likely describes game players, who are often highly motivated by a desire to win (Schwartz et al., 2002).

Thus, the paradox of choice most likely exists in game environments just as it does in the actual world: commercial trends and scientific research both suggest that players prefer games with an increasingly large amount of choice, yet, at the same time, the informational environment of many modern games likely exceeds the limited cognitive capacities of most

players (Lang, 2000). As such, how might players cope with this situation in order to maintain enjoyment? Just as heuristics-based decision-making allowed individuals to survive the time and accuracy pressures of choice selection in an ancestral environment, might such mental mechanisms permit individuals to enjoyably experience (that is, to make numerous choices but without excessive deliberation) the designs of modern virtual environments? To investigate this notion, we must revisit the concept of ecological rationality and consider the alternative methods players are known to employ when making decisions in games.

Making Decisions in Video Games: The Dual Pursuit of Optimization and Enjoyment

The classic economics perspective of unbounded rationality contends that decision-makers seek to make choices that are optimal or that at least approach optimization (von Neumann & Morgenstern, 1947). For decision-makers to achieve this they must identify all of the relevant options at hand, gather all pertinent information about those options, weight and compare the options based on this information, and then select the one with the greatest relative payoff. As noted above, such an approach is often not plausible in certain choice environments for various reasons: the information processing required may exceed the cognitive limits of the decision-maker (information overload); or perhaps external pressures (such as time) require a decision to be made before the optimal choice can be identified. Therefore, as previously mentioned, when faced with such a choice environment, the ecologically rational approach to decision-making may be to employ basic heuristics – mental shortcuts that permit the individual to make "fast and frugal" decisions. The rationality of these heuristics was first tested by the selective pressures of our ancestor's evolutionary choice environment, and this adaptive toolbox has since been passed on to be employed in modern environments.

We propose that modern video games, abound with choices and information, are present-day environments in which a reliance on heuristics may serve the interest of the decision-maker. This proposition is derived from the basic idea that players not only want to win (which requires good decisions), but also want to pursue other motivations, such as fun (which for many individuals requires avoiding the negative consequences of excessive deliberation). In the following section we review four different methods by which players may make decisions. We suggest that each method likely reflects an alternate ecological rationality based on how a given player balances the dual motivations of optimization and enjoyment – motivations that, much like accuracy and speed in our ancestral environment, may sometimes be at odds with one another. We argue that different levels of player preference for each of these two goals jointly requires different types of information and that, in turn, different methods of decision-making are alternatively the most rational when dealing with the paradox of choice in video games.

Method 1: Rational Deliberation

Rational deliberation has been painted in a somewhat negative light in the preceding sections due to the fact that players must remove themselves from other aspects of play in order to deliberate upon a choice. However, even with the large number of choices available in some modern games, it may be a good idea to provide players with decisions where they must carefully consider their options. Rational deliberation is the process of attempting to gather complete information about the choice environment in order to determine the optimal solution, and in games players often do this by attempting to understand the underlying mechanics and formulas of the virtual environment. As Yee (2006) has noted this is a task that a subgroup of players finds both appealing and rewarding. Rational deliberation can also provide a tool for learning in online multiplayer games, as it fosters what Steinkuehler & Duncan (2008) have

identified as “scientific habits of the mind” (p.530). They refer to it in this way because rational deliberation among community members leads to a cycle of empirically guided theorizing and modeling about the game world, and this process bears a close resemblance to the method scientists use to classify, explain, and predict reality.

With the group of players who enjoy rational deliberation, there is little or no conflict between the goals of optimization and enjoyment. These players derive satisfaction from the exploration of content and the application of that information toward the maximization of in-game decisions. Despite – or perhaps because – these environments pose such a cognitively laborious task, they are enjoyable for these players. For them, the path to mastery and optimization is part of the pleasure of playing.

Method 2: Employing Satisficing

However, deliberation is not for everyone, particularly not for players who do not find information gathering and comparison to be intrinsically motivating. Such players are instead much more susceptible to the potential frustration, paralysis, or dissatisfaction that can accompany information overload. For them the pursuit of optimization can conflict with the pursuit of enjoyment in the game environment; indeed, individuals who seek optimization tend to feel worse about their choices when the number of potential options increases (Schwartz et al, 2002). But what decision-making strategy is most rational for players that want to make good decisions that will aid them in overcoming challenges posed by the environment, yet do not want to deliberate over every plausible choice and choice attribute?

As when faced with the paradox of choice in the real world, players in this position can employ simple satisficing heuristics. With this strategy, decision-makers select the first option that satisfies any of various criteria (Simon, 1955, 1956). In doing so, “cognitive demand is

lowered, satisfaction is stabilized, and regret in attenuated" (Lenton, et al., 2010, p. 151). In a game environment, this means a player sacrifices some degree of optimization in order to reduce the amount of information that must be gathered and/or factored into a decision. In other words, they make what they consider "good enough" decisions based on a satisficing criterion in order to get on with the game.

Recall that using simple heuristics can aid satisficing and may reduce cognitive load in multiple ways (Todd, 2007), an exercise that could otherwise intrude upon a player's enjoyment. For one, it may limit the amount of choices a player initially must compare – for example, a player in the market for a new magical sword may go with the first sword that has a +10 or better Strength bonus; once such a sword is found, no further options need be sought. Second, such a heuristic tool may reduce the amount of information the player needs to compare between known options. If that same player has established that there are a dozen swords to choose from, he might use their relative bonuses to his character's ability to kill demons as his sole criterion, disregarding a comparison between other relative benefits. Third, a heuristic can provide a means for making a "good enough" decision in the face of time pressure or apathy, such as when a player just selects the default option simply to keep the story or action moving. In any case, the player forfeits the possibility of greater optimization in his choice in order to avoid more information. Or, in commercial terms, the player gives up the exploration of certain game material and options so as to more quickly progress through to the final content of the game. In a game where a realistically high criterion can be set with little effort spent on gathering contextual information, satisficing can offer significant relative gameplay benefits compared to fully deliberating over all possible options. However, in environments where is it difficult to set criterions with relatively little information work, such metrics may be poorly founded and result

in outcomes that are no better than chance. In other words, dependent upon the transparency of information a given game, satisficing can be a perilous strategy for those players seeking to truly minimize deliberation. Regardless, such players are resigned to striking a balance between optimal outcomes and enjoyment, which is not the sign of good game design.

Method 3: Employing Social Heuristics

What if players want to employ heuristics (so as to reduce deliberation and get on with the game, as above) but do not wish to sacrifice optimization? As noted earlier, the concept of ecological rationality tells us that the rationality of a decision is based on both 1) the relative payoff compared to other options, and 2) the informational allowances of the environment. Thus, if a player refused to change the payoff or his reliance on heuristics, he has to change the informational environment within which he is making decisions. That is, he has to gain access to the type of information that will make the use of other heuristics (besides mere satisficing) more rational.

As more and more modern video games have taken advantage of online networking to allow shared gameplay experiences between players, the information afforded to a given player increasingly transcends the performance feedback or attribute indices that exist as part of a virtual world's "physical" environment. In addition to the presentation of choice and attribute information that is hardwired into a game, players in these choice environments also have access to a variety of pertinent social cues and community-derived information. For instance, in many MMO video games, a novice player can infer quite a bit about the relative value of certain choices by playing with other more experienced individuals. Group questing and raiding allows for the vicarious learning of strategies for combating difficult opponents, navigating through dangerous terrains, and establishing the relative worth (in terms of both in-game currency and in-

game prestige) of rare treasures. Additionally, design features of many of these environments allow players to readily note transparent information about the decisions made by others. For example, in *World of Warcraft* a player can "inspect" another player, permitting her to observe, amongst other things, the virtual items with which the second player has chosen to equip herself. In *Call of Duty: Modern Warfare 2*, after a player is killed in online play a replay video flashes on the screen, again showing the player's death, but from the strategic location and angle of the player that killed him. Further, many games, including the two mentioned above, have verbal and non-verbal chat channels by which players can explicitly convey messages to each other, where the relative value of a given choice or strategy may be conveyed in a variety of ways – ranging from novice-friendly discussion to social judgments shrouded in trash-talking and game-specific jargon. Social gameplay features such as these can be particularly useful and informative tools when in the company of another player that has performed especially well, in a fashion one wishes to emulate.

Thus, by observing specific social cues – including the practices, comments, and even appearances of others characters in a virtual space – players may garner a wealth of relevant information about the strategies implemented by others. Whether actively sought or passively acquired, once gathered this information lends itself quite well to common social heuristics – decision-making shortcuts that are based on social signals of the local environment. Players can use this information to implement conventions such as "copy the successful" or "copy the majority" for guiding their own in-game decisions (Boyd & Richerson, 2005; Wisdom & Goldstone, 2010). In doing so they can leverage the knowledge and experience of others in order to make reasonably good decisions (good enough for those that succeed or for the majority of one's peers) when faced with a game filled with choices and attributes, yet do so without

excessive deliberation or the cost of personal trial and error. In this manner, players alter the informational environment of their gameplay experience, gathering only the information needed (that based upon the performances and trends of selected others, as opposed to directly testing the game's feedback on a given choice) in order make the same good decisions as others. Further, by appropriately identifying and imitating the higher-performing models, not only can players attain payoffs that approach optimization (more so than by satisficing), but they can do so at minimal personal cost. Social heuristics, therefore, are similar to satisficing heuristics in that they can allow players to get on with the game and avoid the negatives associated with deliberation; however, they are unlike satisficing in that the probability of still optimizing one's decisions is based on one's ability to select the correct sources rather than on chance.

Method 4: Requisitioning External Sources of Expertise

As noted above, the concept of ecological rationality suggests that the rationality of a mode of decision-making is contingent upon the informational allowances of the choice environment and the extent to which optimization of choices is required by the decision-maker. However, in the case of games, enjoyment becomes an additional factor of concern, as it can align or conflict with the pursuit of optimization depending what style of play an individual enjoys. As such, it makes sense for players to differentially use and negotiate through the information provided by the video game choice environment in order to yield certain payoffs. To recap:

- For players who enjoy the prospect of extended and calculated exploration of choices and attributes, deliberation or "doing science" is rational, as the requirements for optimization and enjoyment are aligned.
- For players not seeking optimization and instead prioritizing progress through a game environment, satisficing is an ecologically rational approach to decision-making. For

these individuals, it is well worth dismissing some options and sacrificing optimization in order to escape the tyranny of choice. However, in an unfriendly choice environment where establishing a realistically rewarding criterion can be difficult, satisficing may be risky and perform no better than selection by random chance.

- For those players wishing to come closer to optimization, social heuristics can potentially increase relative payoffs compared to those reaped by satisficing– as long as the player can identify the appropriate social cues and models. At the same time, this allows the player to limit the amount of information required to succeed. Therefore, considering the respective import of optimization and deliberation-avoidance for these individuals, social heuristics are ecologically rational.

In these three methods for dealing with the information overload that exists in modern game environments, we see a range of insistence on optimization and a range of refusal to deliberate. Of these three approaches, the only way to guarantee a chance at optimization is to accept deliberation and forego the enjoyment-benefits of heuristics.

In any choice environment, to rely on heuristics alone when sifting through the all relevant information simply requires that the decision-maker accept the possibility of "good enough" choices as opposed to optimal performance. However, while this was acceptable in an ancestral environment, where being successful enough to survive was the bottom line, this may not be the case for players navigating through the informational environments of modern video games. For many players, suboptimal performance may equate to losing – if not against the hardcoded challenges themselves, then in light of the meta-game of player records, prestige, and social status. In other words, "good enough" may simply not be good enough for the most demanding of players in these environments. However, is there any recourse for these players – individuals

who want to maximize their winnings, but also want to do so with minimal frustration and cognitive exertion? That is, is there a way it can be ecologically rational to insist on heuristics *and* hope for optimization in environments overloaded with information?

Again, ecological rationality can be thought of as an equation between payoffs, mode of decision-making, and information. If these maximizing players demand optimization but refuse deliberation, the only variable that can be altered is the structure the informational environment. One way for this to occur is for designers to create "decision aids that can put reasonable limits on choice", thereby reducing the cognitive load of deliberation of complete information (Lenton, et al., 2010, p. 163) However, highly motivated players have not patiently waited for designers to make the first move in constructing such choice experiences. Rather, when presented with in-game decisions that require deliberation for the selection of optimal choices (e.g., the optimal allocation of talent points for a given specialization, or the optimal group composition for defeating a difficult boss), thousands of players instead turn to pooled information sources external to the video game itself[1]. In social forums, wikis, and other sources secondary to the game environment itself, enterprising players who are doing science are provided with additional rewards for publicly providing their personal knowledge and expertise[2]; in turn, players who wish to forego deliberation can instead refer to these resources in order to immediately and directly access the key pieces of information needed for optimizing a given decision in-game. In other words, when pressured by both a need for speed (to return to the more fun elements of play) and a need for accuracy (a desire to optimize one's choices), players may rely on alternate informational environments in which "fast and frugal" heuristics can be used to make decisions.

[1] Examples of the typical caliber and polish of these pooled knowledge resources for players include www.wowpoluar.com , www.ffxiah.com, www.tentonhammer.com, and http://wow.allakhazam.com .

[2] Social capital within the community of players, feelings of personal validation, and monetary rewards may be derived from the attention paid within these third party knowledge resource.

Such a tactic by players supports research regarding choice and expertise, which has demonstrated that individuals can indeed avoid the tyranny of choice when they have access to the opinions of experts (De Charms, 1968; Deci & Ryan, 1985; Lepper, 1983; Zuckerman, et al., 1978). Decision-makers rely on expert information to simplify the number of available choices and to provide themselves with accurate and salient cues for decision-making. In many respects, this is similar to what players employing social heuristics are doing, (indeed, players referring of these knowledge resources may rely on social and performance cues such as guild membership, forum membership length, or number of years spent playing the game in selecting which particular expert contributor's advice to follow). However, the chief distinction is that while those players merely refer to expertise within the choice environments themselves, the players in this fourth group take it upon themselves to locate even more efficient external sources of expert knowledge, where the pertinent information is presented even more clearly and directly.

In turning to pooled knowledge resources, these players are restructuring the informational environment of their gameplay experiences so that reliance on the adaptive toolbox for optimization is an ecologically rational strategy.

Implications for Game Design

Ultimately, the way that a player makes decisions is a reflection of individual differences in the nature of enjoyment. Some players enjoy deliberation, some will do anything to avoid it. Some will satisfice, while others want to optimize even if they're not willing to do the cognitive heavy-lifting to sift through alternative choices. The concept of ecological rationality highlights these distinctions, illustrating how players structure the informational environment of their gameplay experiences in a manner that fits their preferred method for decision-making.

So what can designers of game environments do to maximize the enjoyment experienced by each of these different types of players? Additionally, how might they create environments that cater to one type without potentially disrupting the enjoyment to be had by another?

Many Choices, More Transparent Cues

As both research and commercial sales illustrate, players generally prefer to have more options. Further, as noted above, some players particularly enjoy the process of gathering choice data and testing the relative value of different in-game decisions. Therefore, though reducing the amount of customization and narrative choices that games offer to players would reduce the frustration, paralysis, and dissatisfaction that can result from information overload, it would completely alienate those players that enjoy "doing science" in these environments and likely turn away many other players as well.

Instead, we suggest that designers lessen information overload not by reducing choices, but instead by making relevant choice information more readily discernible. One method by which designers can increase the ecological rationality of heuristics-based reasoning is to make the decisions and relative successes of other players publicly available and easily recognizable. For instance, the *World of Warcraft Armory* (www.wowarmory.com) allows players to search for information on virtual items, teams, and markets through a streamlined interface. However, unlike many other online information resources pertaining to the game, this database is produced by the game company itself, with numbers and values derived directly from the game servers. By releasing this information through a user-friendly, easily easy-to-search repository, the designers permit players to more easily and explicitly identify social trends and their implications for in-game success – cues which allow for heuristics such as "copy the successful" or "copy the majority" to be readily applied. Thus, the *WoW Armory* serves as an excellent

example of the sort of decision-aiding devices called for by Lenton and colleagues (2010), in that it limits the information load placed on users.

Additionally, if databases like the *Armory* are designed so as to formally rank, gauge, and challenge the performances of individual players and teams through public leaderboards or other competitive listings, they may have added value for players seeking social prestige. That is, in addition to helping restructure the informational environment for players intrinsically motivated to employ heuristics, these systems may serve as external reinforcers for players seeking status. In doing so, they can help guarantee that the performances other players may emulate are of high value. For example, such a database may track and rank the ten highest-damage-inducing builds of equipment for a warrior character. In turn, other players can quickly search this leaderboard (without sifting through other information) and copy the specifications used by the top player.

In making certain performance and decision information more transparent and readily accessible, such pooled knowledge resources do not need to provide any information on the actual mechanics underlying gameplay. Databases can solely list the results of player decisions and actions rather than descriptively explain them. As a result, those players that enjoy the process of deliberation and "doing science" in game environments are still left with puzzles to solve and theories to test. Such players are still permitted the satisfaction of attempting to maximize the payoffs of their choices by systematically exploring the mechanics of the game; however, a player less inclined toward deliberation are also allowed to experience the enjoyment inherent in mastering in-game challenges, as he can inform his decisions with the relative success of the choices of others. In other words, such resources make the use of heuristics an ecologically rational strategy by restructuring the delivery and presentation of key information

only for the players who want it; others can still experience the same game content on their own terms in accordance with their own motivations.

Simplified Comparison of Choice Attributes

In addition to making the decisions and outcomes of others more public and saliently accessed, designers can increase the ecological rationality of using heuristics in game environments through the design and structure of choice attributes. For example, if the majority of players prefer to have choices but do not wish to commit excessive amounts of time to deliberating options instead of progressing through content, designers may consider simply reducing the number of attributes by which alternative choices may be compared. Fasolo et al. (2007) note that one way to escape the tyranny of choice while maintaining a diversity of options is to limit the total amount of attribute values that a decision-maker must evaluate. If many players are likely only going to process a subset of the total information in the environment anyhow (whether satisficing, relying on social heuristics in-game, or turning to external knowledge resources), cutting down the number of attributes may make choices easier and more satisfying. Of course, in decreasing the total pool of data to be examined, this approach may estrange the portion of players that enjoy the deliberation process in game environments. As such, before employing this approach it may be wise for designers to consider the relative proportion of players in their base that enjoy this method of decision-making.

In addition to simply decreasing the number of attributes, designers can also minimize the cognitive strain placed on players by creating non-conflicting attributes (Fasolo, et al., 2007). One way to do this is to have all the attributes of a choice option be positively correlated across the alternatives in question. In this scenario, magical cape *A* would be superior or equal to the alternative *B* in all attributes, making the optimal choice obvious. On the other hand, designers

can reduce attribute conflict by simply assigning greater in-game importance to key attributes. In this case, cape A would be inferior to cape B on some metrics, but still be superior on the majority of attributes in which a given player would be most interested. While it may seem as if the attributes of lesser import in such a scenario are now worthless, it is important to note that a designer could set different attributes to be of differing relative importance for different players. For example, cape A may be designed so as to be of superior quality in all attributes that are useful to a player with a burly warrior character, yet cape B could have greater values for all attributes of significance for a frail, spell-casting mage character. In this manner, conflicting attributes can be avoiding so as to decrease the deliberative effort required on part of the player, but at the same time can make sure all objects have a market-specific value.

Summary

The paradox of choice – by which individuals both prefer but may also be adversely affected by a larger number of choices – is a well-documented phenomenon that has been observed in a number of contexts. Further, it has been noted that a reliance on the heuristics found within our brain's "adaptive toolbox" may or may not be an appropriate method by which to cope with a tyranny of choices. The rationality of such an approach to decision-making is dependent upon the external informational environment – provided with the appropriate environmental cues, such "fast and frugal" rules of thumb may lead to equal (or even greater) relative payoffs compared to deliberating over all options and their attributes (Todd, 2000, 2007). Other times, such cognitive short-cuts may oversimplify matters, to the cost of the decision-maker (Lenton, et al., 2010).

This paper proposes that contemporary commercial video games serve as modern choice environments in which players often employ the adaptive toolbox in an attempt to escape the

tyranny of virtual choice. However, the rationality of this approach is dependent upon how well the relative motivations and gameplay styles of a given player fit the informational environment of the game space. Players seeking to optimize choices and that enjoy the process of gathering and comparing all information do fine to deliberate. However, many other players prefer to avoid the tyranny of choice through cognitive shortcuts that can often only guarantee "good enough" returns and sometimes do no better than chance. This paper suggests that those players that enjoy the cognitive ease of using heuristics *yet also* insist upon optimization have therefore taken it upon themselves to restructure the informational affordances of their gameplay experience, such that a reliance on the adaptive toolbox is not only "good enough" but very close to optimal.

We suggest a few methods by which the creators of these modern choice environments can assist players in these efforts, proposing that designers provide decision-aiding features which allow players to reduce choice information in accordance with their own decision-making needs and gameplay motivations. Such provisions would assist players by offering limited transparency into the mechanics of the game, but total transparency into the choices of other players. In doing, the information load of the environment can be reduced by player per individual prerogative, while the choice load of the shared environment is maintained. In addition to increasing the relative salience and transparency of information in this per-need fashion, designers are also urged to reduce cognitive load on players by crafting choices options that can be compared through clear and limited attributes.

One potential limitation of this paper is its attention to only four methods by which players may make decisions – rational deliberation, satisficing, copying modeled behaviors, and requisitioning expert knowledge. These are not the only decision-making techniques available to

players: for example, the emotionally-driven decision-making and moral choice are two methods that have been left unexplored.

Another limitation of this paper is the fact that it relies solely on the authors' expertise in game environments, anecdotal evidence, and logical conclusions to build a theoretical link exploring how ecological rationality and an understanding of heuristics can enlighten game development. While it is certainly a weakness that no game-specific research yet validates the theoretical conclusions herein, we believe that this paper can serve to pave the way for focused empirical research. It is our hope that future research can validate the claim that the paradox of choice is indeed a problem in game environments, similar to how previous work has established its presence in other digital choice environments (Lenton, et al., 2010). Additionally, we hope that researchers and designers will also test how the concept of ecological rationality and a consideration of heuristics might be used to create optimal play environments. Finally, we hope that this paper will spur work demonstrating that players will develop emergent solutions to problems that they find in game environments. Just like players have devised Dragon Kill Points to overcome the problem of loot distribution in guilds and raid groups, it seems possible that players have created pooled knowledge resources as social reward systems for rational deliberators and as a way to simplify choice problems so that players who want to fall back on fast and frugal heuristics can still make optimal choices.

References

Ariely, D. (2008). *Predictably irrational: The hidden forces that shape our decisions*. New York: Harper.

Bailey, R., Wise, K., & Bolls, P. (2009). How avatar customizability affects children's arousal and subjective presence during junk food-sponsored online video games *CyberPsychology & Behavior, 12*(3), 277-283.

Bartle, R. (1996). Hearts, clubs, diamonds, spades: Players who suit MUDs. *Journal of Virtual Environments, 1*(1).

Boyd, R., & Richerson, P. (2005). *The origin and evolution of cultures*. New York: Oxford University Press.

Castronova, E., & Fairfield, J. (2007). Dragon kill points: A summary whitepaper. *SSRN eLibrary*, from http://ssrn.com/paper=958945

Cordova, D. I., & Lepper, M. R. (1996). Intrinsic motivation and the process of learning: Beneficial effects of contextualization, personalization, and choice. *Journal of Educational Psychology*, *88*(4), 715-730.

Dawes, R. M. (1979). The robust beauty of improper linear models in decision making. *American Psychologist, 34*(7), 571-582.

De Charms, R. (1968). *Personal causation: The internal affective determinants of behavior*: Academic Press New York.

Deci, E. (1975). *Intrinsic motivation*. New York: Plenum Press.

Deci, E. (1981). *The pychology of self-determination*. Lexington, MA: Health.

Deci, E., & Ryan, R. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Springer.

Fasolo, B., McClelland, G., & Todd, P. (2007). Escaping the tyranny of choice: When fewer attributes make choice easier. *Marketing Theory, 7*(1), 13.

Gigerenzer, G. (2008). Why heuristics work. *Perspectives on Psychological Science, 3*(1), 20-29.

Gigerenzer, G., & Goldstein, D. (1996). Reasoning the fast and frugal way: Models of bounded rationality. *Psychological Review, 103*(4), 650-669.

Gigerenzer, G., & Selten, R. (Eds.). (2001). *The adaptive toolbox*. Cambridge, MA: MIT Press.

Gigerenzer, G., & Todd, P. (1999). *Simple heuristics that make us smart*. New York: Oxford University Press.

Goldstein, D., & Gigerenzer, G. (2002). Models of ecological rationality: The recognition heuristic. *Psychological Review, 109*(1), 75-90.

Iyengar, S., & Lepper, M. (2000). When choice is demotivating: Can one desire too much of a good thing? *Journal of Personality and Social Psychology, 79*(6), 995-1006.

Iyengar, S., Wells, R., & Schwartz, B. (2006). Doing better but feeling worse. *Psychological Science, 17*(2), 143.

Johnson, E., & Goldstein, D. (2003). Do defaults save lives? *Science, 302*(5649), 1338-1339.

Kahneman, D., Slovic, P., & Tversky, A. (1982). *Judgement under uncertainty: Heuristics and biases.* . New York: Cambridge University Press.

Lang, A. (2000). The limited capacity model of mediated message processing. *Journal of Communication, 50*(1), 46-70.

Lenton, A. P., Fasolo, B., & Todd, P. (2010). Who Is in *your* shopping cart? Expected and experienced effects of choice abundance in the online dating context. In N. Kock (Ed.), *Evolutionary Psychology and Information Systems Research* (Vol. 24, pp. 149-167): Springer US.

Lepper, M. (1983). Social control processes and the internalization of social values: An attributional perspective. In E. Higgins, D. Ruble & W. Hartup (Eds.), *Social cognition and social development* (pp. 294-330). New York: Cambridge University Press.

Lim, S., & Reeves, B. (2009). Being in the game: Effects of avatar choice and point of view on psychophysiological responses during play. *Media Psychology, 12*(4), 348-370.

Malone, K. (2009). Dragon kill points: The economics of power gamers. *Games and Culture, 4*(3), 296-316.

Piattelli-Palmarini, M. (1996). *Inevitable illusions: How mistakes of reason rule our minds*. New York: Wiley.

Ryan, R., & Deci, E. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology, 25*(1), 54-67.

Ryan, R., Rigby, C., & Przybylski, A. (2006). The motivational pull of video games: A self-determination theory approach. *Motivation and Emotion, 30*(4), 344-360.

Schwartz, B. (2000). Self-determination: The tyranny of freedom. *American Psychologist, 55*(1), 79-88.

Schwartz, B. (2005). *The paradox of choice: Why more is less*. New York: Harper Perennial.

Schwartz, B., Ward, A., Monterosso, J., Lyubomirsky, S., White, K., & Lehman, D. (2002). Maximizing versus satisficing: Happiness is a matter of choice. *Journal of Personality and Social Psychology, 83*(5), 1178-1197.

Shah, A., & Wolford, G. (2007). Buying behavior as a function of parametric variation of number of choices. *Psychological Science, 18*(5), 369.

Shanteau, J., & Thomas, R. (2000). Fast and frugal heuristics: What about unfriendly environments? *Behavioral and Brain Sciences, 23*(5), 762-763.

Sherry, J. (2006). Flow and media enjoyment. *Communication Theory, 14*(4), 328-347.

Simon, H. (1955). A behavioral model of rational choice. *The quarterly journal of economics, 69*(1), 99-118.

Simon, H. (1956). Rational choice and the structure of environments. *Psychological Review, 63*(1), 129-138.

Steinkuehler, C., & Duncan, S. (2008). Scientific habits of mind in virtual worlds. *Journal of Science Education and Technology, 17*(6), 530-543.

Todd, P. (2000). The ecological rationality of mechanisms evolved to make up minds. *American Behavioral Scientists, 43*(6), 940-956.

Todd, P. (2007). How much information do we need? *European Journal of Operational Research, 177*(3), 1317-1332.

Trivers, R. L. (1971). The evolution of reciprocal altruism. *The Quarterly Review of Biology, 46*(1), 35.

Tversky, A., & Kahneman, D. (1986). Rational choice and the framing of decisions. *The Journal of Business, 59*(4), S251 - S278.

von Neumann, J., & Morgenstern, O. (1947). *Theory of games and economic behavior* (2nd ed.). Princeton: Princeton University Press.

Wisdom, T. N., & Goldstone, R. L. (2010). Social learning and cumulative innovations in a networked group. In S. K. Chai, J. J. Salerno & P. L. Mabry (Eds.), *Advances in Social Computing* (Vol. 6007/2010, pp. 32-41). Heidelberg: Springer-Verlag Berlin.

Yee, N. (2006). The demographics, motivations, and derived experiences of users of massively multi-user online graphical environments. *Presence-Teleoperators and Virtual Environments, 15*(3), 309-329.

Zuckerman, M., Porac, J., Lathin, D., & Deci, E. (1978). On the importance of self-determination for intrinsically-motivated behavior. *Personality and Social Psychology Bulletin, 4*(3), 443.