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The Philosophy of Decision-Making: Principles, Ethics, and Rationality

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Abstract

The philosophy of decision-making examines the fundamental principles and processes underlying human choices. It investigates how epistemology, ethics, and logic shape the evaluation and selection of alternatives. Contemporary research in this field spans from mathematical and computational models of rational choice to qualitative approaches that address the complexity of decisions in contexts of uncertainty. By integrating insights from philosophy, psychology, economics, and decision theory, the field provides a comprehensive framework for understanding both the normative and descriptive aspects of human decision-making. Ultimately, it seeks to clarify not only how decisions are made, but also how they ought to be made within ethical and rational parameters.

Keywords Decision-Making, Philosophy, Ethics, Rationality, Decision Theory, Uncertainty

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1. Introduction to Decision Theory

Decision theory (DT) is a conceptual terrain on which philosophers, economists, psychologists and computer scientists meet to study human decisionmaking. It is an active field of interdisciplinary research, in which the object of analysis is a decision-making agent, person or organisation that attempts the rational choice among a single agent. Decision theory, as it is usually conceived, refers to de Finetti's precept of subjective probability. Preference relations have a specification more sophisticated than those of the observable support set of choice revealed by choice behaviour. A specification of preference is a pair (f, U) such that f is a measurable function with respect to a -finite measure and U is a random opening on the Borel algebra of [0, 1] defined by f. It could be claimed the approach of DT is self-sufficient. But at least four caveats could be raised.

Choice behaviour has been studied since antiquity in its own right, without ever referencing DT. The deep social relevance of choice behaviour in explaining criminal activity, fraud, political elections, price negotiations and sports competitions has been documented by economists. A DT theorist viewing these phenomena exclusively through the prism of rationality and probability modelling would miss the salient features. In the context of modelling risk, machines could be considered in their own right. There is no need for a human agent to frame the objective probabilities upon which machines would operate. It is conceivable that machines could simulate human traits, such as impulsivity, timidity, envy and greed without these engendering behavioral explanations in terms of personality or observational learning. Neurophysiological documentation of discrete and continuous time integers in brain modulation is not yet 'serious' biophysics but does not exclude brain machines for optimal forecasting of sensory data.

Finally, behavioural game theory could be claimed as an alternative to DT in which choice behaviour in human settings has been studied exhaustively. Socioendogenous constructs out of the realm of DT have been proposed in modelling fair and moral behaviour (Hassall, 2007). However, similar to the caveats already mentioned, this would mean the transgression of philosophical bounds.

2. Historical Perspectives

The historical roots of decision theory are rooted in three major disciplines: mathematics, statistics, and economics (Hassall, 2007). Expert decision theory originated in early attempts to solve leisure-time problems related to gambling and fair games. Applied sciences and professions investigated decisions made in the workplace, where significant time was allocated to finding answers. Several universities hired staff with advanced degrees in applied decision theory. A central theory developed in industrial management, operations research, which appeared shortly after 1945. Its emergence in the early years of the twenty-first century was a politically explosive issue. The history of decisions is long, but the history of decision theory is brief. Decisions can be studied from many different perspectives. These perspectives can be categorized as three pairs of extremes: specific or vague; deterministic or stochastic; analytical or intuitive. In this categorization, the historians of decision theory divide the great works in the last century. The historical perspective on decision theory continues to grow, and many lines remain to be standardized. Questions like: Where will decision theory go? What will happen next? What should be investigated next? may arise. The decision theory is not free from being a continuous dynamic game. Although human beings are taught about and have some knowledge of past decisions, this history better resembles a nest of black boxes, where every positive integer indicates a new hidden problem discovered, proper to investigate and learn from. Such an beauty and its impossibility is central to the definitions of "human". The first great mathematician of decision was Pierre de Fermat (1601-1665) in purposed some problems in gambling games. He solved that the game should have to be stopped at an arbitrary point at the beginning of the gambling and presented a general solution to method to treat the games. The first very well-known mathematician-philosopher is Blaise Pascal (1623-1662) who was forced by Fermat to substantiate his results in a wider frame including differential and infinitesimals. After an intense professional rivalry, similar efforts were independently conducted by Christine de Euler-Miranda (1706-1789) and Jakob de Bernoulli (1654-1705) leading to the axiomatic theory of probability and subjective probabilities definition clarifying the importance of stupidity efforts.

2.1. Ancient Philosophical Views

No one can deny the significance of decision-making in the context of absolutely every social and personal activity. Even at the macro level, the leaders of countries, politicians, chiefs of organizations, and heads of religious groups while exercising their rights often decide under certain values. Similarly, on a micro level, in personal life everyday activities of people, such as selection of clothes for the day, meals in restaurants, shopping of goods, etc., are all taken after a brief deliberation over the matter.

The philosophical discussions on decision making date back to the ancient times. The great thinkers like Socrates, Plato and, Aristotle have written elaborately on the philosophical aspect of human decision making. This section presents the foundational views of these ancient philosophers on human decision making. Socrates, the teacher of Plato, is famous for the assertion "Know thyself". His immediate concern

was human behavior and the moral dimension of the same. He believed that human beings are bound to do good because of the very sake of the good. If someone does wrong, he encounters adverse effects of his deed / decision, which would ultimately distance him from the good entity.

Unlike the majority of human agents who go wrong in spite of having this knowledge, he put forth a counter argument that knowledge of the good is not adequate for deliberation towards it, but a consideration of the possible bad consequences as well (Müller, 2016). He talked of the idea of Basileus, or the King, powerful enough to protect the state and rule in accordance to the good, because of his accurate knowledge of the good being. This idea was taken to become the monolithic account of the Good God. Plato was altogether different than both his teacher and student. He attempted the problem of good ways of action under this dualistic framework: in which cases the truth and belief, and knowledge and opinion are the same. Action was believed to be an outcome of decision. The finest decision was thought to lead to the finest act or choice.

In every particular domain, decision is termed Victor (Hassall, 2007). It is an expectation of a world which is regarded true without doubt and whereby the domain is dichotomously divided into finer particulars (i.e., either yes or no), based on the theorems.

2.2. Modern Developments

The early twentieth century saw the emergence of a view of decision and decision making that rejected the certainty of being able to infer truth from ideal rationality decisions. This perspective remained dominant amongst philosophers and some theologians until well into the mid-century. However, it is difficult to sweep phenomenology aside, in any culture, for ever. Starting from the twenty second year of this century, a new wave of interest in decision making has occurred, which respects the ideas of the moderns but seeks to explore the deeper structures of reality and Being enshrined within the ideal rationality of the very best decision theorists. Going further, it seeks to understand what it is to be human and thus to be able to have a particular perspective on Being and its meanings. In particular, it seeks to establish what it is to make a decision (Hassall, 2007). Many of the issues arise directly from the writings of Soren Kierkegaard.

An important activity of a human is the making of decisions. Decisions can range from trivial to hugely consequential. There is broad agreement that the ideal rationality decision theorists are pure classics, the classical position on Being put to its maximum head of steam. The classicists believe in an external reality that can be inferred as truth via language based on logic and mathematics and using scientific kinds of observations, measurements and experiments. Their views were initially totally mathematical and thus extremely abstract but were made more concrete by the modelling conventions of operations research. Whether it is with respect to a component or whole, a set, a process or a selection of outcomes or performance measures, analysis is enlisted to define operationally well-specified problems, minimization/maximization criteria and decision algorithms.

3. Key Concepts in Decision Making

A prevalent definition of choice is “the act of choosing; selection.” But, like many things, there is more than one lens through which to examine the phenomenon of choice. In Western culture, a great deal has been written regarding the philosophical concept of how future realities and present behavior are related. (Hassall, 2007)

Choice arises from a previous or concurrent act of deliberation. Here one sees a sequence in which each of the components can be analyzed in turn; deliberation regarding possible subsequent actions, then selection of acting on one of them, followed by acting. The sequential model can give rise to a class of mechanisms for supporting choice based on enabling one or both of the first two components of the above sequence.

Expanding upon the phenomenological definition of decision, therefore, choice is a human act with an essential nature and structure, referring to the state of an individual ‘I’ who has a decision-maker’s

attributes ‘uncertain action A’, which is a prospect involving material or immaterial time variables such as risk and uncertainty. The individual ‘I’ discourses and chooses one principle, ‘p’, with which the uncertain action A will be completed as an expected contribution in a way that the decision-maker agrees (or disregards) with others to establish the decision. The decision-maker then implements A as an act. (Fair, 2014)

Whether or not they have a complete conscious grasp of this view if pictured at the same level, discursively labeling the components and depth of choice while recognizing decision’s essences and structures enables the dialog of entities at a level similar to probabilistic “circumstance”. A decision model captures the macrolevel of the achievement of a choice via aggregation within, or aggregate across, conscious agents utilizing this view. Assessing this construction’s privacy and ethics rely on consideration of consequences to participation and decision-making as a parameter.

3.1. Rationality

In its broadest and most neutral sense, rationality can be defined as conformity to good reasoning. An alternative conception of rationality, more popularly accepted, is an epistemic one according to which rationality is defined as conformity to rules of reasoning that define what it is to think and believe correctly. That is, rationality prescribes rules of reasoning that determine how people ought to think, believe, and act in order to be correct in their reasoning, beliefs, and actions (Moshman, 1994). A person possesses good reasons for her beliefs, and rationality is satisfied to the extent that she has good reasons for what she thinks and does. If in reasoning from her justification J of belief p to belief q something has gone wrong mentally, so that q does not follow from J, her reasoning is inadequate. This inadequacy of reasoning must itself be due to inadequate reasons. This is because, in arguing a point of view, it is necessary to produce adequate reasons to justify or warrant that point of view. If these reasons are inadequate reasons, the reasons for a belief might not justify what is believed. It would then be possible to object, by a counterexample, that appeal to them does not make 'me', the reasoner, rational (Staras, 2019). If one’s reasoning is inadequate; it must be considered whether the reasons for what one has come to think and do, through reasoning, conform to objectively defensible norms of good reasoning. Rationality then is defined as an objectivity of reasoning, according to which a person ought to reason in a certain way and such reasoning is capable of producing objectively defensible reasoning. In this view, a perfect rational agent is taken to be one whose reasoning is infallible, providing not only adequate but also good reasons. Rationality as an objectivity of reasoning relies on a firm view of reasoning. What is rational and what is justified must hold irrespective of the thoughts and beliefs of the reasoner. In contrast, if reasoning is primary but considered as relatable to the thoughts and beliefs of the reasoner, rationality is inner. It is seen as a subjectivity of reasoning, distinct in the mode of accounting the adequacy of reasoning.

3.2. Utility Theory

Utility Theory, as proposed by Von Neumann and Morgenstern, has been used as a theoretical framework for modelling rational behaviour in gambling (Kontek, 2010). However, it has been pointed out that this theory predicts that people should always prefer the game with the highest probability, which cannot explain many gambling aspects presented in earlier sections. As a result, researchers have focused on looking for other approaches for gambling behaviour modelling that do not rely on Utility Theory. Nonetheless, this theory is still used to explain many aspects of gambling.

One interesting aspect of this theory is an introduction of a lottery valuation mechanism consisting of two stages. According to this mechanism, each lottery has a certainty equivalent that is defined as the value of the sure win lottery, which would yield the same utility as the valued lottery. It has been concluded that this valuation is composed of a two-stage process. In the first stage, a predictor forming a decision utility curve considers each outcome of a lottery and its weight. The outcomes are multiplied by their weights and summed to get the decision utility value of the lottery. The final stage is precisely as described in the axioms, where the lottery is valued by the certainty equivalent of the decision utility value instead of the

payoff. The two-stage lottery valuation mechanism can successfully explain why the option with the highest probability is not always chosen.

The optimal decision criterion based on the Value Theory states that an option should be chosen according to the value maximization throughout the decision procedure to derive the best option from many alternatives. It consists of a two-stage value computation where the entire decision problem is decomposed into simple ones. The Value Theory has been illustrated to explain how the best option is determined in many decision-making situations (H. Giang & P. Shenoy, 2004). Also by applying a similar value maximization criterion to search for the best option for experimenting with games of chance. It has been found that maximization of decision utility indicates that a lottery with a greater expected value should be chosen if the two lotteries differ only in the range of their payoffs.

3.3. Risk and Uncertainty

A further distinction must be drawn between risk and uncertainty. A precise definition of risk takes account of an agent's knowledge of the probabilities of events corresponding to the outcomes of acts. Like rational choice theory, this narrower definition of risk takes account only of actual rather than potential information. On this basis, a decision problem is uncertain if there exists some choice function representing all judgers such that for at least some profiles of option expectation matrices, this choice function ranks the options differently than the standard expected. Decision situations are risky if all judgers have the same known prior probabilities about the states (Mislavsky, 2018). The concept of risk is clearly well defined. It suffices to show that the required choice-theoretic conditions hold for a suitably simple and well-defined class of models. This is relatively easy to do for a class of nonlinear functionals on the extended real numbers.

Uncertainty and risk have often been conflated. In decision situations that are uncertain, prior probabilities are not common knowledge. Decisions are risky, however, if there are some precise probabilities about the states of nature such that all agents who assess the same choice problem will recognize and agree upon decisions given their attitude towards risk. Given these conventions, mainly used in economics, an attempt is made to construct a choice theory of uncertainty. It is proposed that there exist bounds on the rest of the structure of choice when the choice-indicating sets are independent. Thus, both restrictions of the way agents' preferences relate to that structure must be dropped. This requires some new modeling devices such as a generalization of Becker-DeGroot-Marschak mechanisms. It is shown that unicity/helpfulness determines the bounds and that a specific upper bound holds for all adequately chosen normal mechanisms with highly symmetric structures.

4. Ethical Considerations

Decision-making is often burdened with external time pressure and personal situational pressures. In ethics, decision heuristics leading to systemic reasoning errors and biases have been described. Certain biases may lead to a violation of ethical principles. Such biases can be caused by external time pressure but also found in self-imposed time neglection, habitual approaches, and overstepping own limits. The literature on decision-making states that explanations of affecting heuristics and biases can counteract their influence. Reflection on the decision-making conditions may slow down the hastily done reasoning and identify the unsatisfactory outcome. Awareness of influencing cognitive conditions is introduced in a teaching approach: an introduction to empirical evidence of influencing biases, a presentation of the method of conscious decision-making as a competent alternative to simple heuristics, and training in the application of this method to the area of ethical decision making. Human beings process information in two ways, intuitively and analytically. Intuitive reasoning is usually a fast and easily-accessible form of information processing but heuristic biases may lead to mistakes in conclusions. Mostly, these heuristics catch simple information that hits exact situations but are inapplicable to misleading even though formally correct presentations of situations. In contrast, analytical reasoning is a slow form of information process and it may include circumstantial and irrelevant information. In health care, a lack of time is a dominating phenomenon faced by every health care professional. Excessive intonation within a decision may result in discrepancies regarding the relevance of the situation. A more complete time-

frame of thought should be taken into account, thus it may bring the loss of time and expiration of time. But ongoing time is not easily realizable. A conscious time-consuming approach based on explicit aspects may slow down the reasonings. Habits and rules of thumb, paradigms and analogies which are simple heuristics are frequently a solution in medicine. The risk is the loss of complexity and mismatch of the case with the rule. Habits may persist at the expense of newly learned rules (Albisser Schleger et al., 2018). An analytic decision strategy is delineated by tailored aspects that lead to a satisfying answer of a dose question that has been pre-selected.

4.1. Consequentialism

Consequentialists argue that what ultimately makes one action better than another is its consequences (W. Portmore, 1970). This is controversial because it is easy to think of pairs of acts that differ in value on a number of important dimensions and that produce similar consequences in terms of their net effects on these dimensions. For example, given a choice between a nonnefarious act that a person has a moral obligation to do and a nefarious act that a person has no obligation to do, it is plausible to suppose that the former on balance has better consequences than the latter. Further, the nefarious act might function as a God's eye view to produce better consequences than the nonnefarious act. Yet, intuitively, the latter is better than the former. In response, the consequentialist denies that such morally relevant dimensions are disqualified from characterizing value differences between acts. Rather, they argue that these morally relevant dimensions matter only ultimately because of the effects they have on the good things and bad things for sentient beings in the world.

Nevertheless, philosophers and laypersons routinely criticize the consequentialist approach as being too focused on the good and bad consequences ascribed to acts. Consider the argument against indirect consequentialism (IC). IC evidently holds that the permissible acts are those that are sanctioned by a set of preferences with respect to acts that have ultimate value based upon their consequences. Perhaps weakened in a consequentialist way, it says that the permissible acts are those which do not produce worse consequences than those sanctioned acts. And most often, it is arguable that there are acts of taking the hearing aid and going along with the nefarious act, which do not produce worse consequences than the sanctioned acts. In short, it is plausible to argue that some acts not permissible on the normal reading of the consequentialist approach at least do not produce worse consequences.

4.2. Deontological Ethics

In contrast to the consequentialist view where actions are evaluated chiefly with respect of their outcome, the deontological view rests onto a morality of 'duty'. Here, choice of action is viewed in relation with certain ethical principles or norms and such norms are thereby considered as, in principle, binding for agents. Actions have to be judged as morally right or wrong according to whether they are considered as respectively obeying or violating a certain ethical norm. Unlike the consequentialist approach that consequently poses utilitarian ethical norms, deontological ethics is usually thought to allow for a much smaller set of obligations and duties.

Actions, decisions, and choices, here, are value-free. Matters of choice can be influenced by any factor under the premise that the choice itself is made with respect of certain measures that are viewed as ethically binding. Agents may thus justify their decisions quite differently, say by stating that they tried to maximize the benefit for themselves or that they took the needs of others into account as the overriding factor in their decision (Capraro et al., 2018). The question of ethical behavior or moral norm violation in the deontological framework can be reduced to whether an agent is 'allowing' what, under the prescriptive 'ought', should have been regarded as morally important and binding when deciding. Such a view is likewise complementary to the previous consequentialist notion.

While coupled with a philosophical and conceptual question, this captures an aspect of deontological ethics to none of which questions counterpart, assessment of morality. This suggests, of course, a whole separate discussion and analysis of possible answers as do its consequences with regard of ethical decision making or moral behavior. It has been mentioned that the deontological view is claimed to be of

Kantian origin. Accordingly, it is conceived as fundamentally different to consequentialist theories and by the same token requiring different empirical study and paradigms. Such deontological moral judgments do not need to depend on whether or not a specific choice of action is liable to affect well-being in a larger context.

4.3. Virtue Ethics

Virtue ethics had sunk into near-oblivion by the middle of the twentieth century. The enormous strides and achievements of modernity in the material and control sciences all contributed to the view that questions of right and wrong were for more practical and productive intellectual fields than the unquantifiable realm of ethics. Behaviorism informed by the materialist scientific view saw ethics as a mere veil behind which lurked nothing other than the biological survival advantage of a species. So only at great expense were ethics modules reluctantly included in economic and management courses. But the rise of the corporate and financial services behemoths, along with ever enlarging war machines, warned that once unleashed it was impossible to predict or control the behavior of their agents. As a consequence, anything with even the slightest relevance to ethics soared in price and demand. A rebirth of interest in virtue ethics took place. Work in virtue ethics resumed in earnest and with required vigour (Pettigrove, 2018).

Most work in neo-Aristotelian virtue ethics begins by supposing that the virtues are the traits of character that make us good people, where this is understood as promoting the good. This suggests an egoistic theory of the virtues: the virtues just are those traits of character that reliably promote the well-being of their possessor. In addition to making the positive case for character egoism, I defend it from some anticipated objections. Most importantly, I argue that character egoism doesn't inherit the problems of ethical egoism. In the first section I try to clarify and motivate the plausible position that the virtues are traits of character that make one good, converting this into an egoistic position in the second. In the third section I address some anticipated objections to egoism from admirers of virtue ethics who try to insist that somehow virtue ethics must include altruism (Stoner, 2011).

5. Cognitive Biases in Decision Making

Decision-making is a complex problem, significantly broad scope, numerous variables, complex correlations between variables, and dramatic consequences, however carrying a developmental potential, even when incorrect. Therefore, a need for a systematic exploration of the decision-making entity, the degree of rationality of decision-makers, as well as their cognitive limitations and mechanisms for coping with them arises. A discussion on the bias types that can occur within general decision-making processes constitutes a valid basis for future research dedicated to the analysis of the decision-making cells of the system, appreciate and improve the quality of business entities-oriented decision-making processes. Decision-making biases due to the complexity of phenomena, the number of variables, and their interdependence. The influence of information asymmetry leads to the emergence of information barriers imposed by decision-makers on their colleagues or subordinates, caused by the fear that knowledge empowers. This indicates a lack of teamwork in decision-making processes, filtration of collected information, poorer problem formulation, bad assessment of alternatives, biased information nerves feed, biased recognition of the feasibility of anticipated effects, unpredicted effects, unclear estimation of effect probabilities, and an inaccurate description of models of complex phenomena.

Based on previous experience, decision-makers could decide to analyze given questions, or certain parts of them only and undertake to synthesize existing alternatives into a complete or partial preference assessment as a group basis. Discovery of new facets of alternatives cannot arise through a group process, individual focus leads to subjective formulation of alternatives, potential procedures, indifference towards alternatives, incorrect expectation of overcome possibilities based on procedures. Decision-makers adapt to circumstances by formulating personal preferences on the existing pool of alternatives which can be subjective and far from the objective state. Information filtration on a personal basis could

lead to unexpected alternatives but the valuation must be based on subjective assessment methods. A problem that can occur is the missed consideration of an alternative that due to huge knowledge or experience gaps could not be formulated. The decision-makers' cognitive spheres, expectations/possibilities gaps create information barriers, which can generate a poor decision-making process outcome. The decision-makers' available amount of knowledge often overcomes the information filtering abilities. Since decision-makers possess cognitive limitations and the world around them is complex, rules must be simple, and the decision-making process must be simplified.

5.1. Types of Cognitive Biases

Cognitive biases are systematic errors in thinking that can affect decision making. They can have many different causes and can influence an individual or group's judgment in either a positive or negative way. These cognitive biases stem from the limitations of the decision-makers themselves and from the limits of information transmission and the potential confusion between information and knowledge (Nikolic, 2018). Because man acts in a world of uncertainties and imprecise information, cognition is imperfect. Cognitive limitations of decision-makers, just like those of computers, limit the extent of the information gathering and processing processes from which decisions arise. The limitations of cognitive capabilities result in the incapacity to process all of the relevant pieces of information, expectations, alternatives, and strategies, and so, at best, only a filtrated collection of information can be processed satisfactorily, while much of the information is completely ignored. Hence, the process of selection is not merely an inevitable simplification from the vastness of information, but also an alteration of data that gives rise to an entirely different view of the same situation. This is a result of a bias or a mental shortcut as it is generally referred to. Consequently, the theories regarding the use of geometric means are inadequate in explaining observed behavior since they support the assumption of ideal conditions. Decision-makers do apply shortcuts, i.e. heuristics to simplify the over-complex decision making. A heuristic refers to the quality of probabilities or choices but not necessarily both. Decision-makers make a choice based on the application of simplified rules and inadequate models of decision making and not through the more complicated processes of analytic probabilities and expected utility modeling. Yet, the process, as with biases, can also run in the opposite direction and yield better decisions than a normative analytic procedure. The application of cognitive shortcuts is not invariability systematic but can be very outcome specific. Depending on a specific context or a specific population, either the biases can prevail and give rise to prejudiced decisions or heuristics can dominate and lead to decisions that are purely rational. In practice, either can happen and sometimes the same numerical information can lead to different conclusions when approached with different perspectives. Nevertheless, attempts have been made to identify a small number of cognitive biases that are the most persistent and most representative defects found in common decision-making processes.

5.2. Impact on Rational Decision Making

Decision making is a fundamental constituent of managerial practices across a broad spectrum of contexts (Fair, 2014). Despite high economic and time costs associated with decision making, executives frequently make inconsistent decisions and typically exhibit grave deficiencies in psychological processes involved in decision making. Improved understanding of the psychology surrounding decision making may enhance the chances of the engineering of better quality decisions. However, such an improvement in understanding cannot be achieved simply through the intensification of cognitive effort. These implicit and compounded informational cues, incorporated in the psychology of decision making, cannot be made explicitly available through information analysis. Emotions and biases often transcend cognition in rendered judgments, thus accounting for a rationality process perspective of decision making. Rationality and flexibility of decision making have the potential to co-exist. Consequentially, a new definition of rational decision making is explored, in which "understood utilities appropriately discounted against probabilities" is further examined as a foundation on which improved decision making might be preferred. In general, decision alternatives are described by payoffs and probabilities. In common parlance, when payoffs have been acknowledged, it is understood, across practically all cultures, that higher probabilities equate with better decisions. However, across option lotteries comparing payoffs,

decision makers routinely prefer options with lesser value and greater certainty. This tendency operates enormously across fundamentally distinct cultures, indicative of a universal bias or behavioural richness. Continued exploration follows, in which bounds of rationality provide some appraisal of distinctions in behavior across options with the same expected value. Decision makers reveal basic misconceptions in making decisions under uncertainty, in that "the illustrative preference for receiving $100 with certainty over receiving a 50 percent chance of receiving $250". Educational effects on preferences between common gambles are greater than previously documented. Other bias frameworks explain behaviours distinct from framing; probability weighting is defined at the same time as value distortion. Finally, the impact of number representation formats on risk attitudes is explored. On average, better decisions appear to be predicated on poorer understanding of both options and probabilities by decision makers, which has baffled naturalistic theorists for some time, and precludes the articulation of normative principles. The agenda of naturalistic decision theories is primarily a descriptive one. Normative precepts do not describe the dynamics of decision processes, but singularly clarify how decisions ought to be made.

6. The Role of Emotions

One of the most ambitious projects of explaining human behavior and decision making in particular, is to puzzle together the contributions of reason and emotion (Luo & Yu, 2015). People have long believed that emotion tends to lead one astray, while reason can clarify choices. It is universally believed across cultures that emotions are paramount in human life and many of life's peaks would not be possible without such feelings. Thus, it is unlikely that decision makers abandon perceptions and assessments but give weight to visceral passion instead. There is more to rationality than a deliberative procedure; underlying assumptions, mental models, and relevance have pre-filtered inputs—sources of confusion and error—prior to the cognitive process itself. It is also widely believed that reason and the rational processes it entails ought to suppress the passions. However, even in ordinary affairs, rationality often fails where the emotions soar. Both cognition and emotion may alter judgments and the weight afforded to particular pieces of information and suppress the presence of particular heuristics or processes of inference from others.

Philosophers in Antiquity tended to regard reason and passion as similarly monolithic inputs to the deliberative process. However, the diversity of possible emotional responses in both type and variation of intensity raises the question of why some emotions ought to be chosen over others. Information and content have also been understood to vary in other ways besides by their conformity with preference—particularly by their perceived relevance for example to presently salient goals. States of mind concerning the relevance and truth of a proposition will impact on the deliberative process and even suppress influence from certain comparable premises. All of these variations have been examined theoretically but broadly, and none has been examined in a bird's eye view as comprehensive to cognition or emotion alone. Since this literature considers human cognitive capacity not as a simple set of mechanisms generating outputs, but as a multidisciplinary architecture of different layers, arms, and paths, it is difficult to see how alternative approaches could be applied in isolation to decision making without a trade-off.

6.1. Emotional Influence on Decisions

Influences on decisions are complicated and subject to many positive and negative influences. On one hand, humans choose the decisions that provide the best overall outcome, which improves the prospects for survival. Meanwhile, they have affective and cognitive influences that distort or bias their decisions. Cognitive distortions and biases are problems that can manifest in philosophy and in reasoning processes. The challenges facing affective influences on decisions have gotten less exposure despite their importance.

Emotions arise from environmental events, and influence decision-making tasks as much as preference and desire. Decision-making tasks are often interpersonally loaded, or related to life decisions. Studies show that different emotions affect the decisions that individuals make. Despite the diversity of effects that emotion can have on decision-making relative to the expression, intensity or the object of the

emotion, a general direction to these influences is often present. Furthermore, the role of emotion in decision-making tasks has been shown to depend on processing capabilities and task structures.

Research on the influence of individual emotions on decision making are less variable and explore a more unified concern, focusing on the nuances of decision tasks. Of all social and affective signals, emotions can change organizational decision-making and reasoning abilities to a great degree. Understanding the effect of emotions is necessary to cope with the inherent risks brought by these strong affective signals. There are six basic emotion clusters: a potential two-dimensional model was proposed that labels the basic emotions with combinations of the two dimensions of arousal and valence. Each emotion in individuals seems to be the embodiment of the two dimensions; for instance, happiness, anger or fear concerns the high valence dimension, while fear, sadness or interest is part of the high arousal dimension.

Basic emotion clusters further evolved into more complex or composite emotions in order to filter social meteorological phenomena. Explaining the effects of basic emotions would inevitably expand the research domain, which is already vast, due to the product multiplication effect of heterogeneous intensity, time span, individual differences, and decision variety.

6.2. Emotional Intelligence

As stated by (S. Drigas & Papoutsi, 2018), anyone can become angry-that is easy. But to be angry with the right person, to the right degree, at the right time, for the right purpose, and in the right way-this is not easy. Emotional Intelligence is the ability to identify, understand, and use emotions positively to manage anxiety, communicate well, empathize, overcome issues, solve problems, and manage conflicts. According to the Ability EI model, it is the perception, evaluation, and management of emotions in yourself and others. “Emotional Intelligence” (EI), or the ability to perceive, use, understand, and regulate emotions, is a relatively new concept that attempts to connect both emotion and cognition. American psychologists Peter Salovey and John Mayer define emotional intelligence as the ability to monitor one’s own and other’s emotions, to discriminate among them, and to use the information to guide one’s thinking and actions. People who have developed their emotional intelligence have the ability to use their emotions to direct thoughts and behavior and to understand their own feelings and others’ feelings accurately.

Having Emotional Intelligence has also been suggested as a way to circumvent the biases of Lack of Mental Capacity. There are four dimensions of EI as a model which follows a layered model.

7. Decision Making in Groups

It is a commonplace observation that decisions can be made by individuals or by groups. Much of the theory in this area focuses on decisions made by single agents, examining and analyzing how decisions should be made (prescriptive approach), and how they are made (descriptive approach). Formal criteria have been proposed for making those decisions that should be made rationally, arguing against departures from that ideal. Focusing on decisions made by agents viewed as “individuals” ignores an important part of human life. Many decisions are made by groups, such as committees, boards, teams, coalitions, and societies. And group decisions can differ from individual decisions in a number of important ways.

Interest in group decisions is more than academic curiosity. Groups often make decisions that are of direct importance to individuals. Both public policies and private policies affecting health care and education are often made by groups. How do some of those decisions get made? How ought they to be made? Decision theory is in need of formal models of how decisions are made by groups. Decision rules (or procedures) vary widely across groups in terms of the numbers of agents involved and the numbers of alternatives evaluated (or actions available), ranging from simply weighing the opinions of a few individuals to elaborate score and voting procedures that can consider dozens of options with masses of data.

Some findings of research on group decision making have been surprising. In general, groups tend to make better decisions than individuals facing the same problem. Groups take longer to make decisions

than individuals, often by long intervals. Those long periods of deliberation will lead to victims of groupthink consensus even when evidence to the contrary is present ((R. Forsyth, 1985)). There are many variables that influence this process, including the size of the group and its relative numerical expertise; the nature of the discussion, e.g. whether it's positive and constructive or negative and biased; the norms regulating the decision-making process; the nature of the decision rule, e.g. the procedure used to arrive at a decision; and the quality of information used.

Discussion can improve the group's decision quality, streamlining the process through which the group's expertise is brought to bear on the decision. The quality of those deliberations can be influenced by the quality of the information that is considered in making decisions. Groups are influenced by the quality of the information (((Aurélien) Baillon et al., 2016)). Procedures to eliminate erroneous or subjective information can improve decision quality. Groups consider a more diverse range of information than individuals. Whenever possible, group decisions ought to be made in a manner similar to the decision-making process in social choice.

7.1. Groupthink

Groupthink refers to a deterioration of mental efficiency, reality testing, and moral judgment that results from in-group pressures (D. Johnson & L. II Weaver, 1992). The social psychologist Janis, who originally coined the term, labels this deteriorating decision-making process "groupthink." There have been a number of significant groupthink events over the last couple of decades, including the Bay of Pigs fiasco, decisions about the Vietnam War, and the 1986 Challenger disaster. There is potential danger that excessively cohesive groups of decision makers may ignore outside information and fall prey to groupthink. Three key concepts in Janis' definition of groupthink are cohesiveness, in-group, and unanimity. Groupthink occurs in groups that consist of "cohesive" members. Janis notes that the concept has long had a variety of meanings. Cohesiveness can describe a group that is bound by sentiment or feeling. Janis believes that decision makers' performance in a group is determined by the degree of cohesiveness that prevails. The greater the extent of cohesiveness, the greater the likelihood that the group will make decisions that amount to groupthink, which occurs as a deterioration in the perception and moral judgment of group members. The notion of the in-group is also central in Janis' definition of groupthink. An in-group is a group with which one closely identifies. It is a trust group whose approval is important to the individual and whose rejection is treated with dread. Membership in the in-group, Janis believes, is likely to overpower the dictate of an individual conscience. Individuals might do or endorse something that they would not entertain outside the in-group. Kickbacks for government contracts provide a good example. Janis elaborates on the dichotomy of viewing the world in terms of "we" and "they" in the definitions of groupthink. With respect to in-groups and out-groups, groupthink leads members of the group to ignore outside information that said their original ideas were poor. Janis also points out how this tightly knit friendship binds in-group members (R. Forsyth, 1985). There are pressures exerted on members of the in-group to conform, even among normally aggressive Wan people. Members almost invariably fall in line during an initial "body-blow" attack.

7.2. Collaborative Decision Making

In recent years, collaborative approaches to decision making have gained prominence in pre-policy contexts, with the understanding that ill-structured and 'wicked' problems are best addressed collaboratively. Collaborative decisions are expected to be better decisions because consideration of alternative viewpoints and assessment of the implications of each alternative are desired as well as necessary. Moreover, in collaborative decision making, developing an understanding of one another's viewpoints and coming to a decision which is more likely to be accepted by all is sought. Such consensus is, in decision-making literature, sought about a final plan from which it is difficult to retreat (Cockerill & DOCKS at Appalachian State University, 2009). In policy domains, this problem is magnified by the complexity and messiness of the decision context.

In the 'traditional' contrast of between both urgent and important, quick-and-dirty decisions are often taken to "go with the flow". Examples of better decision processes are interviews with participants in

decision-making processes in living labs. The conversation about these processes shows how initial disagreement developed into a productive exploration of mutual concerns. Whether deliberative workshops or interfaces to tools for collaborative modeling have been considered, a sole narrative, with little if any confrontation, seems desirable to avoid distress to decision-makers. Yet, much of the literature on decision making emphasizes a clear role for difference in view. It is suggested that asynchronous searching for 'good enough' options should precede debate about the pros and cons of the options. In some policy problems, groups form across disciplines and backgrounds to frame problems, yet there is witnessed a drift to consensus that excludes options deemed difficult to justify.

In the context of these dilemmas with discussions across difference and consensus, literature on collaborative and participatory approaches suggests an addressing or side-stepping of this question. Participatory modeling is framed here, as it can facilitate discussion about important and urgent decisions with diverse stakeholders, being processes that situate discussion and decision making amongst both concerned parties and other stakeholders, across either a whole or part of a problem domain. Framing how collaborative modeling processes contribute to better decision making draws on both the perspective of a strengthening of deliberative democracy and of an answerability of the policy sciences to the public.

8. Philosophical Implications of Decision Making

There is some overlap between presentational and procedural aspects of type I decision making; however, a philosophical distinction can be made (Hassall, 2007). From a subjective perspective, procedural descriptions of decision making need to be placed within a larger contextual framework. This framework enables people to understand or to make sense of procedural aspects. Both case studies illustrate how the underlying goal of the decision support systems was to help users learn rules within a context; emphasis is placed upon teaching how to process a given model instead of providing a model of how to construct a grammar of graphic-to-physical transformations. Similarly, to natural language, human judgment involves modeling rules that direct a range of actions in a specific situation. From an ontological perspective, simplifications can render the decision space tractable; yet, a multi-faceted description also conveys a sense of uncertainty about the meaning of the decision. Visually analyzing possible projection paths can entail a large number of visual compared to textual analyses, as paths versus for the graph version of the same game.

Objects are aggressive, in an epistemological sense, if they manipulate not just knowledge, but also the act of knowledge attribution and social contexts. As a consequence, expectations about pictorial regularities are structurally coupled to visual-to-conceptual inferences. Arguments depend upon symmetrical relations and there is always the possibility that two arguments can reach the same conclusion, even when the premises differ fundamentally and the second argument is consequently simply invalid. Written forms of knowledge provide persuasive evidence for a prior reasoner, whereas stated that it would be better for them to not have been born. Agreements to endow knowledge and subsequent failures are often irreconcilable.

8.1. Free Will vs Determinism

In historical and contemporary problematics of free will notions in philosophy and scientific assessment, confusion arises from an insufficiently exact definition of terms. Terms like determinism, indeterminism, and free will may be assigned an exact meaning. Incompatibilism and compatibilism can be understood as alternative answers legitimately leading to the correct but equally imperfect answer. The states of compatibility and incompatibility turn out to be two different aspects of the same phenomenon. As free will is harder to classify on wider time scales, it has been paradoxically both assigned a narrower meaning by compatibilism and a wider meaning by incompatibilism than it deserves (Klaus Jansen, 2011). Free will is more likely to be regarded as a compromise. Relativity of the free will concept avoids the contradiction of being free/unfree for the same phenomenon. It is more likely to lead to a lesser number of misinterpretations of terminology. To confusion caused by assigning either side of the alternates an excessive wider meaning of being free/unfree on symmetry-breaking assumptions and

assumptions of free will, compatibility is regarded as a strong correspondence of subjections, and incompatibility as a weak correspondence, considering only the strongest perspective. Compatibilism excludes the suggestion of free will in the deep future and renders a deterministic world free choice paradoxical. Meanwhile, chaos ensures a spontaneous phenomenon without subjection but is not regarded as free. Dynamical descriptions on all time scales, either forward or backward, or both, should be considered. Just because the opposite aspects of two partial deterministic phenomena may be free/unfree respectively does not imply that the entire determinism regarded as an undifferentiated whole cannot be free. The unsolved case of complex event discriminations with unresolved determinism may be free. Mechanical necessitarianism, inattentiveness to innate inclinations, and the induction of freedom by a constant observation lack determinism. Comparative flexibilities may be of relevance in this case, but without endocrine gulf futures, a free present is highly unlikely. Incompatibilism has been assigned to the wider and unlikelier category of free chooser unverifiably moving deterministically.

8.2. Moral Responsibility

The question of moral responsibility has been traditionally inscribed in the context of causal determinism; nevertheless, the central question of the past two decades has rather been about a notion of moral responsibility, finer than the usual one, inquiring whether the responsibility thus considered, what deserves to be called responsibility with a capital R, can withstand a (causal) determined world. There are some stories that, being otherwise equal, place the subject in the position of someone who stands a chance to be responsible for some action; and other stories that, also being otherwise equal, do not. The difference in these stories is not just a matter of more or less depth of the causal narrative either—these stories may just differ with respect to the time in which they were first told. In a broad sense of a well-known philosophical distinction, the truth conditions of these stories differ not both in the neighborhood of being both empirical descriptors of the same world, nor in the neighborhood of being both normative "judgments" concerning these worlds. Indeed, the rationality or justifiability of the statements concerning actions is inscribed—that is interpreted, to put it into narrative terms—into a causal chain that stretches from the causal antecedent of the given action to some near causes concerning its reconstruction of the past on one side, and to some future consequences on the other side. In this long causal chain at least one (and many could be already enough) near causes have the relevant property of "circumstances" while the rest upon which a well grounded reasoned judgment upon the action might be construed fall into the role of the "causes," as, that example of lunatics, consideration for which this reasoned narrative is usually disqualified (Laera, 2014).

Philosophers usually offered "incompatibilist" arguments maintaining that if the world is deterministic in the sense of physical lawfulness there cannot be justifiably any judgment that deserves to be called moral praise, blame or responsibility. The fundamental reason of this incompatibilism is that—at least on the naïve understanding of determinism and of judgment qua statement of moral praise or blame—that determinism would allow to predict the far future of a world on the basis of its past with arbitrary degrees of accuracy. This absence of knowledge and of necessary abilities, does not even put into question the truth of determinism. It rather illustrates than excludes the possibility of a version of compatibilism: for deterministic worlds as far as "possibilities" are concerned it can be established that—though it would have been perfectly determined by this chain of causes if a given action would have been executed or not—there are still stories provided that the action is followed by actions or utterations (also knowing laws describing the world) that place the controller again in the position of someone in "certainty" of still not executed or at least not even applied possibilities. Nevertheless, it cannot be excluded that even within these stories, at a certain stage, probabilities of closer past conditions and of far future consequences may account for their descriptive content being less or more plausible in comparison with the previous ones.

9. Applications of Decision Theory

There are numerous applications for normative or prescriptive decision theory (DT). Some applications may sound uncontroversial, even intractable for all but the most determined. Individual 'widow's peak'

decisions would be a traditional example. Multi-state situations generate significantly greater analytical costs than do bi-state ones. Nevertheless, it is a simple matter to construct problems whose solutions are beyond the competence of even the best decision analysts, but they nevertheless may be doable by simpler minds armed with the right procedures (D Adler, 2008). For example, when proposing a joint average on three generalized votes on Expert #1 and on Expert #2, it is unlikely that most people would or could propose anything better than six simple methods. Individual decisions at the extreme ends of either 'easy' or 'hard' might be described as either absurd or inspiring. Abundant practice with repeated application of guidance heuristics may lead cognizant agents not to state what synthetic indicators are but to expand upon the generic implications of those indicators. It is here that issues of widespread computational or conceptual pragmatism become paramount (Simpson, 1998). There is hardly any need to state a large polity's utility functions over the portfolios of state variables associated with a decision about how the macro-economy is to be regulated. However, it may be perfectly crucial to undertake meticulous modeling of those comparative utility values once portfolios of proposed decisions have been found to be diverging.

9.1. Business and Economics

Business and economics are concerned with how decisions are made and how this affects, and is affected by, the society at large. In this grander scheme of things, decision making is a pertinent issue to be theorized. Decision making can be the individualist way in which a decision is made or the interaction of many individuals to reproduce behaviors. Regarding business and economics, how individuals decide in the firm, how firms interact in the market, are very important issues. This essay will focus on individual decision making. Determining what variables should be included in a model to understand a particular decision-making process is a crucial and sometimes problematic task. Models of decision making are often based on the description of the agents who make the decisions. In economics, it is assumed that an agent arrives at a decision by choosing among a series of other choices. Thus, the agents analyzed by the economists are all rational agents who would arrive at an optimal choice. Most economic theories rest on this assumption. Thus, there are two central problems regarding individual decision making. Although it may seem trivial, these questions urge agents to think about their own assumptions about how decision making, in order to explore any other type of decision making.

The answer, however inconclusive it may seem, has a great amount of implications. It is surprising that despite there are theories as to what strategies should be adopted by attackers and defenders, there is no formal analysis on how to formulate a question regarding a treasure hunt type of situation. Nevertheless, as in any first step in the construction of a theory, it is important to provide a basis as to how the formulation should be aimed. Always present in a decision-making situation is some scarce resources. In economics for example, this resource could be the attention of the audience or time. In context of game playing/problem solving, it is known what goal is to be achieved. Thus, knowing what variables this goal is dependent on, is ex-ante knowledge that every player has. Thus, the question that each player should ask should be: given the HEAD of this treasure hunt type situation, how can I ask a question which tells me information?

9.2. Healthcare Decisions

The healthcare environment is a fast-changing complex system that requires complex decisions to make it run efficiently and effectively. Healthcare is a complex interrelated systems of both tangible and intangible assets composed of the four main components of administration, staffing, clinical facilities and equipment, and health information. Healthcare administrators require to understand decision analysis to enable them make choices after carefully examining the available options. Information gathering and considerations are crucial to the decision of the best choice in the circumstances surrounding the problem. Decisions are made in order to take action for remedying a state presently regarded as undesirable or unwanted. The sources of the problems can either be determined or unknown. Decision science proposes various norms, frameworks, models, and decision support for decision making, resultant analysis of alternatives, evaluation of resource purchase decisions, forecast of possibilities, and

attempt to discovery causal structure. The focus of decision analysis is to assist administrators structure the problems they face, minimize uncertainty about forecasted events, clarify their ideals and preferences, and reduce conflicts that may arise as a result of the chosen options (Masic, 2022). In order to harmonize and streamline decision making in a healthcare organization, values-based decision making is defined as decision making based on the values of the organization and the goals these values support.

Values based decision making becomes more pertinent in resource poor countries where most healthcare services are provided as a public service. In these systems decisions are sometimes taken capriciously or with an overtly partisan and political agenda, through lack of knowledge and understanding of the facts, fears of consequences, or values and emotions that comprise the heart and soul of the issues at stake. A concerted effort is required to overcome these obstacles to ensure that, where possible, the best evidence is brought to bear on a decision. The nature of this evidence and the process of its adoption in a decision will depend on the design of the system in which the decision is made. No matter how large or small an organization, different decision-making systems will be in place, reflecting differences in the tasks that need to be performed, the resources available to perform them, and the organizational authority (Adwok, 2014). Even in simple hierarchies, where one decision maker must approve the decisions of a number of others, there is by and large no uniformity in decision making, nor will it ever be possible to achieve this.

9.3. Public Policy

Public decisions often do not turn on policy values but rather on considerations that vary in kind and importance. Some valuing decisions require simple application of norms in a straightforward manner. Other decisions require weighing interests. Legal norms can be constructed to govern both types of decisions through different decision-makers, procedures and standards. Legal norms may reduce flexible choices to weighing of interests. Discrete, individualized culpability may be imposed. Determining what to do with persons caught after the fact is for courts of law rather than legislation. What ought to be done with such persons involves a policy determination. The possible values involved statement by statement. The legislature may govern situations that do not require policy evaluations such as moral rules providing for prospective sanctions, and prohibit lean-on program every on the ground of policy, rather risk-lowering actions as such but credit monitoring and prosecution going to missed obligations (Maxeiner, 2008).

Legal norms can broadly be classified as policy norms or antinorms under which no ongoing valuing decisions are needed except those unacquainted. Norms may regenerate lagging adoptions and avoids the mobilization of those likely whose cost exceeded the gains. Norms need enforcement-based commitment of resources and potential antagonism on the part of the bodies subject to sanction. Antinorms usually trigger immediate enforcement. Although courts may properly require weights and measures of values, generalized distributive standard of measurement may be devised, one weighted equally in favor of all interests. There are two kinds of commutability of the consideration. Understanding choices of either lobbying class or affected persons within the political fixing, those disadvantaged by incentives, limited to an equal chance to explain their choices which many concessions won. In a nonstochastic world, a formulation warning exercise that limits specifying rounds would be optimal but it entails relying scenario on economic or social science. Understanding conflicts on the ballot for voter's decisions does not involve weighing groups' overall interests against foreseeably generous means to be fully frank.

10. Future Directions in Decision Theory

There is still a great deal of work yet to be done. The most obvious goal is to develop more sophisticated approaches to idealized decision-making. The ideal agent is assumed to know what is true and what is not, but it also seems pretty clear that for most situations of practical concern, the intelligent agent will face a highly uncertain world. (Soares & Fallenstein, 2015) present a framework for modeling uncertainty, in which the world is modeled as one of many possible states each with an associated probability distribution. The framework needs to be fleshed out in great detail in conjunction with its potential applications, and much is still unaddressed. What kinds of systems face which kinds of challenges, and how can these challenges be modeled? On the more philosophical side, it may be asked

whether more account should be taken of the epistemic questions involved. There have already been some preliminary thoughts about this; it would be wise to give more attention to these audience members across all tiers.

Another area for further exploration sits at the intersection of decision theory and game theory, exploring scenarios in which two rational agents can employ their own decision theories to decide how to play a game with another one. The model needs to be fleshed out as a real-world situation involving imperfect common prior, then more explicitly connected to decision-making frameworks. The models are ultimately only worth exploring in the context of populations of agents. Returning to the question of whether there are questions that should be answered in a different way than any current approach does, game theory presents its own puzzles. A single-agent approach can be conventionally taken to such situations, but this approach seems to fall apart in certain parameter regimes. There are some thoughts on this, but these initial reflections would require substantial work to spin out into a meaningfully publishable form.

The goal of future work is to pursue these questions as effectively as possible. It has been foretold that decision theory is a vast pasture of unknown implications. In this initial phase, the best opportunity is to make significant contributions in a few narrow regions, taking cues about where to explore from simple facts about common language. It is almost definitely the case that new questions that have not been anticipated will arise during the investigation of these initial questions, and it is hoped that these questions will in turn generate the most fruitful investigations.

10.1. Interdisciplinary Approaches

Who decides? Who chooses? How to decide? How to choose? What affects the decision? What affects the choice? On what grounds does one choose or decide? Is choosing a human action? What is a choice? What is a decision? How is a decision made? Philosophical discussions about choice and decision can easily be made public and appropriate to the problems that any intelligent person can. Difference between choice and decision: A choice is made when there are two or more possible alternatives and deciding to choose indicates one preference of alternative over others. Choice is the process of judgment whereas decision is on the amount of commitment after judgment. One can choose without deciding or vice versa. Furthermore, choosing serves to identify the problem whereas decision-making denotes preparation for action. How to decide? To decide upon a problem, there are several decision-making procedures. Starting from whether to make a decision or not, an alternation of attention is made between some criteria and alternatives (Hassall, 2007). If a decision is made, attention shifts from decision-making to decision-implementation.

Decision-making is of course a human action which involves some phenomenological processes. It is in this sense that decision-making of one person is human action and agency whereas that of another person is rooted in difficulties in performing human agency. There are decision-making systems, using principle components, or multi-attribute weightings, or goal programming. In using these decision-making systems there has to be any assumption on what is the function of the decision variables and how they should be defined as these functions. Such which is called a model of decision making is a minimal assumption needed to model decision-making. It has far spreading effects on what to understand as choice and decision, and what to understand as use of decision-making systems, and what computers could possibly be used for these decisions. It appears that the choice of a model may implicitly embody a standpoint from which to understand a choice and decision. A model choice is therefore strictly philosophical in this sense. Understanding what is a human decision, is as far as understanding a human body, which reflects a deep structure of a human being.

10.2. Technological Impacts

Technological impacts on decision making have always been a topic of discussion with both positive and negative considerations. On one hand, advancements in technologies such as artificial intelligence, big data analysis, and modelling are predicted to influence how decisions in government, business, finance, and other key areas of society are made. Attention and focus lie on how technology can formulate

decisions and suggest courses of action (David Webster, 2017). Patterns are identified showing how decisions are based on probabilities and risk. This science-based approach to decision making raises questions about whether such techniques can produce better outcomes. For example questions whether technology can consider ethical aspects of decision making instead of a single-minded profit maximisation view like in the case of hedge fund management are raised.

On the other hand, emphasis exists on how technology can mitigate decision making. Issues related to privacy invasion, trust erosion, and knowledge democracy threaten the legitimacy of decision making. Debates show how technology can enhance decision making without threatening political and socioeconomic structures. There is a paradox. A gap exists between how technologies producing and mitigating decision making processes are conceived. One way to address this paradox is to analyse technology-related assumptions, especially philosophical ones, held by individuals and groups of decision makers. This may refer to overtly stated principles, values, beliefs, but also tacit rules and frames. Philosophical assumptions in this context provide answers to ontological questions: how, when, where, and by whom decisions should be made and informed. The philosophy of decision making may influence the choice of decision-making algorithms. Also, it should be a concern of developers, students, and official agencies.

Relatively little research exists that focuses on philosophical assumptions in decision making. With a focus on a single assertive statement, e.g., "Assumptions of how decisions are made or can/should be informed influence the choice of recruitment tools." Departing from a pragmatic, constructivist, and pre-analytic approach, a set of philosophical assumptions with regard to decision making is identified. In-depth qualitative analysis suggests how these assumptions are manifested in practice. Hereby, the epistemology of technology is dealt with, and the results may serve as an initial foundation for further questions on who influences the boundaries of acceptable decision making, how these assumptions should be made explicit, and whether tech developers' assumptions should be as relevant as those of institutions that use technologies to validate their decision making.

11. Conclusion

Philosophical analysis discusses relevant concepts, principles and issues related to decision making in an information theoretic model of an organisation. Early informal consideration of decision making within a cybernetic context is supported. A requirement for enhancing original choice or recommendation is identified. One alternative philosophy of choice is discussed in detail. A process of recognition, resolution and realisation of decision-making choices is described in detail. Essential decision taking methodologies are reviewed. Some shortcomings of these methodologies in general are outlined. Finally, several practical areas where philosophy-based considerations to decision making may be relevant for document digitalisation efforts are mentioned.

Contemporary reaction continues to favour questions of greater or lesser order, or applies personality types to spur more dynamic debate. Early formal mathematical decision theoretic models focused on comparative probability judgements for which suitable comparative fake distributions or estimates are difficult (Hassall, 2007). Information theoretic measures like uncertainty, reliability and surprise, have been shown to be more suited to prompt disclosure and deter backings-off. Such measures focus on collective choice or recommendation. Because they fail to mention original choice, or preceding recommendation credibility, an extension of the original decision model was developed. Comparison class scenarios drawn from historical consensus narrative summaries related to group decision discussion were searched for original recollection or Foley (repudiation, defection), recommendation deniability, and follow up interviewing bias conversational moves. Hypothesis construction based consistent, differential or inconclusive chance estimates for piecemeal scopes of evidence, intent, consequence and testing, relevant soundbite selections for final review scripting, and time design assumptions were needed.

Choice or decision is probably a fundamental aspect of humanity, and hence a behavioural process of the intellect and its social construct, society. However, a philosophy of choice, decision or determination can

be elusive. Even the simpler questions of just what are this choice, decision, determination and will-of-choice, and what are the fundamental processes and early paradigms involved, are rarely discussed. Grounding objectivity, concerns of languages and meaning rather than pure view dependent community versus solitary secure cognition have long since acquired unfortunately glaring omissions.

There are many reasons for wanting to briefly step to a parallel history of inquiry, not least because the seldom recognition of choice, decision or determination down to the level of mere preference in most philosophical discourses since classical times bespeaks summarily profound last residue lacunae in the very foundations of modern theory (C. Bruce, 2011). It is also partly because of inquiries on modernity often revealing newly misunderstood forms and views of aspects of all too old, or suddenly again new familiar, elementaries on the profound foundation level as yet totally unrebuked surplus and unbenefited understandings sitting at the edge of mainstream discourses. There may be something here even comparable to St. Augustine's ceaseless inability to tackle the simple question of time, and yet a clue that closely approaching to the referring totally ultimate existential vacuum inquired at the closure of a recent total descriptive undertaking on the semiotic language of principle ontology of being would begin to open up here in some faraway unwanted corners of shadows.

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