# III-21.   Making Decisions

Humility in the face of persistent great unknowns is the true philosophy. Remember wherever you go that is where you are going to be. So choose carefully – your wish may come true.

Game theory (bounded rationality) is used to model and simulate probabilities of possible outcomes. It is bounded rationality. It is modern variation of dealing with the decision making concerns with the assumption that snippets and vignettes of reality models add up to probable outcomes.

In the discussion thus far we have implicitly assumed the following ill defined model:

Rational feedback

Action ⟶ Outcome

Random acts ⟶ Consequences
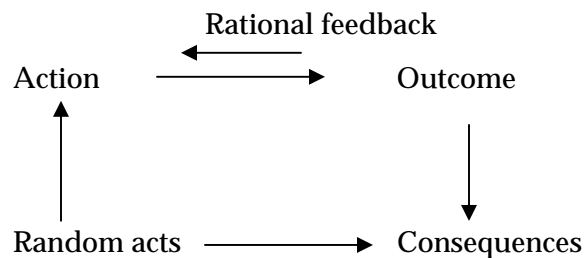
Random actions may have consequences and outcome is not clear. Sustained actions can lead to predictable outcome. Rational feedback from the outcomes facilitates search towards desired consequences. At this level inputs (facts, actions, motivations) and practice build up to the consequences. It is more of an statement. It can not simulated without other information which makes prediction of outcome and consequence evaluation nearly impossible.

One cannot make decisions without options to choose from. All decisions also presuppose something about the future. A decision to act in a particular way is the decision that directs

present to a particular future. It requires planning as well as reverse engineering. It includes abstaining from certain choices, and to adopt or develop a strategy in the context of the other choices. A choice based on the decision also means commitment for action, which requires evaluation of the possible outcomes and their consequences.

Actions codetermine the future. In many cases actions are the decisive factors. Actions depend on the motivation and ability of the person in relation to the environment. Thus one must consider probabilities for the future and deal with dishonesty, or hasty judgment, or plain error in the information on which the decision is based. In the end, the decision process requires reducing many-dimensional valuations to a single chosen hierarchy. It requires ordering of the relevant actions in an uncertain environment. Often chances of success increase if preferences are aggregated into a single preference. The role of logic and reasoning with facts is to eliminate unreasonable solutions, to identify probable alternatives, and discard incongruities.

Rules of the game. Starting belief is that actions have outcome, and decisions have consequences. It is possible to conceive of rules that facilitate doing a single act towards a goal. Not all goals are worth striving for. In more complex situation not every act has desired outcome. Also some choices and decisions are far more consequential. Clearly, there is no method or procedure that always works, and works all the time.

Approaches that increase the reliability of what we know and how we know follow acceptable procedures. For example, the algorithmic and sortal approaches are for incremental validation of knowledge. They rely on justification of existing

beliefs, as well as on new algorithmic inputs of facts and options as they become available. Examination of the implications is critical for long-term validity.

Once established algorithmic approaches lose the sense of inquiry. The procedures deteriorate to the sortal terms of instrumental evaluation of objects. This is not much different from rituals and other (theo-, auto-, techno-, bureau-) cratic approaches. The sortal terms provide the basis for developing the criteria for consequence evaluations based on the use to which objects are to be put. Sorting criteria are based only on what is known. The sortal method does not deal with unknown or ignored criteria. The approach is mechanical and works well for writing specifications for machine parts.

In the consequence evaluation of human actions we are concerned with who is affected by the consequences. Often it is not just the actors or players. Thus all actions are of concern if they influence others directly or indirectly through the institutions or the commons that we rely on collectively. Just passing the buck (blame or responsibility) for the social costs to some entity that is not in the sortal equation is not an adequate solution.

Anything can be built into the matrix of consequence, ranging from how you feel to the utility of the outcome evaluated against self-goal versus individual goal. Much deeper issues lurk underneath the game theoretic approaches. To begin with, goals have to be realistic in a given context, although dreamers do find and establish their place in the scheme of things. If reasons for doing an act affect its utility, then attempting to build this utility into its consequences will also alter the act, and possibly change the reasons for doing it. This results in a feedback loop where, through constant reevaluation, actions have to be iterated towards a desired goal. In this pursuit, principles and rules are useful

starting points: Principle to navigate through the unknowns, and rules for apply the domain of certainty from prior knowledge and current probabilities.

Substantive versus procedural. Bounded rationality is part of all processes by which humans use information to make decision, solve problems, and learn.   What constitutes rational or even reasonable can be reached only by viewing the behavior in the context of a set of premises or givens. Such premises differ in regard to goals and values, as well as to the consistency of behavior in relation to the total environment (space and time).

In economics rationality is based on the choices it produces. In social sciences rationality is viewed in terms of the processes it employs. Sociologists are concerned with the origins of the values. They seek to describe reasoning about actions. They seek to determine the use of very limited information processing capabilities to cope with complex realities. They seek to describe and explain how nonrational processes (motivations, emotions, stimuli) influence the focus of attention. All of this has to be done and set in terms of the known and factual givens for the rational outcomes.

Perceptions develop with acknowledged inputs. Bounded rationality is the information and knowledge-seeking process. The concept of information is crucial to methodology. The reliability of information is a paramount concern. The efficiency of the process and pragmatism come later, if at all. Probabilities judged by the experts can rarely be counted to establish the more subjective aspects of satisfiability.

Being informed is about having a question answered. Relevant information and the validity of the result of inquiry is knowledge. Relevant and suitable information transforms the decision. Misinformation can lead to regret. Use of information

for decision-making depends on the suitable use of complex relations. In the game-theory sense this may be of the type *he knows that I know he knows.* Ultimately, the decisions and the foreseeable consequences of actions bear on prediction.

The study of future behavior and goals is also relevant to making choices. It is said that information relative to a problem, whatever that means, leads to better decisions for future action. Here are some considerations for *perfect* information, and the list of criteria is often culled for pragmatic reasons:

1. Categorical information differs from probabilistic information in precision and scope.

2. Reliability of information influences its utility.

3. Reliability of information is related to the reliability of its source.

4. Is the information relevant based on direct or indirect evidence?

5. Is the usability based on induction or deduction?

6. Does the information transform an ill-defined problem into a well-defined decision problem?

7. Questions related to the cost and sufficiency of information.

8. Methods of analysis are about causality. The end and means argument for ethical moral issues results from the use of incomplete knowledge or from the use of selective information.

9. Consideration of the unintended consequences.

10. Relationship between the information and the source.

Such factors are difficult to quantify for any analysis. Probabilistic description is useful for calculating the expected utility. The probabilistic view of information ignores the fact that information about certain events is not meaningfully expressed in probabilistic terms, such as the birthday of a person or the genetic code. Semantics is presupposed in the validity of information as

true or false or reliable. In fact such relations do not become information unless singled out, observed and asserted. We often treat semantic information as true and act on it. It must be abandoned when the consequences of the erroneous identification of the states of the world are serious enough. Such characterizations do not yield easily to probabilistic interpretation. **Hypothetical nature of decision-making**. Revival of the action-consequence hypothesis has come from the suggestion that hypotheses based on statistical data are tested in order to guide decisions. Hypotheses do not stem from the brow of Zeus, but from prior information about the world. The hypotheses are not to be a priori: such as animal spirits, man as aggressive animal, money illusion, sexual stereotypes, or Man was made in the image of God.

Reality-based decisions are grounded in facts established by direct observation. Every theory has a central core that is considered inviolable by its adherents. However, this core is always surrounded by a host of auxiliary hypotheses. In the long run, these and more serious disagreements in sciences are settled empirically. This is done systematically in terms of available facts. This requires attention to key details for utility maximization. Here the basic premise is that the reward should be in proportion to the risk. Put another way, the product of utility and probability (chance) of success should increase with effort and actions. **The goal of all decisions is utility maximization**. Rational expectation is that humans try to better themselves. Economic and other motivations are critical for the survival needs and well being of the individual and the group. Social behaviors are bounded by contractual relations. Also behavior choices are limited by constraints on motivations and opportunism. With this simple model, if expectations are always formed rationally, the

corresponding economic system tends to steer rapidly towards equilibrium. Rationality implies that at equilibrium people have no motivation to modify their behaviors, and resources will be fully employed. Clearly, such models of group behavior that leads to loss of motivation are not desirable.

The classical equilibrium for the markets is between supply and demand. Underlying variables include innovation, capital accumulation and population increase. Such an idealized situation would produce a constantly changing steady state supported by utilization of resources. Such a state is interrupted with shocks and business cycles. This is not a regression to *an anything can happen* scenario. In such cases failure of rationality may be the failure to correctly interpret available information. In other words, optimal response does not rule out illusions and delusions.

The rationality assumption in the supply and demand scenario requires implicitly that the actors attend to all of the *important* variables about which one has to make decisions, or which can inform the decisions. Unfortunately, the number of variables and information that one must attend to are innumerable. Thus one approaches the problem through a simplified model and the subset of variables that enter into it. The decision-maker has the problem of dealing with a simplified model of the world, making decisions in terms of the simplified model, and of noticing when the model is to be changed. Such responsibility apply to all trajectories for actions.

Learning from new inputs. Easier said than done. Learning from failures is absolutely critical for making desirable choices. In the game theory failure is treated as the loss function. Operationally such a function is introduced as the procedure for minimizing the undesirable choices and maximizing the desirable outcomes.

Statistical inferences are also built around prior probabilities, and such probabilities are assigned on the basis of the prior information (including knowledge and assumptions). Even the statistical interpretation of apparently random occurrences is modified (informed) by new information that changes the weight of the priors. Thus we learn by eliminating the contradictions. We also weigh in the internal inconsistencies as well as the broader inconsistencies with other relevant parts of the world that we discover later.

As on the Monty Hall TV show (III-1) if the probabilities based on the prior information can be assigned, according to Bayes the posterior probabilities are to be reassigned on the weight of each bit of information that emerges later. Each new bit of valid information is not an isolated world unto itself, but it provides an informed basis to continually modify the ensemble of desirable choices formulated as hypothesis.

In closing, key ideas about bounded rationality from the game-theory approach are about maximizing the utility of effort and minimizing regrets from mistakes. They revolve around the premise that the decision for a change to something better is about realizing the latent potential. It is not a zero sum game if value is created. Both rational and irrational outcomes are possible because we rarely have complete knowledge to make rational decisions. In effect, rationality lies in modulating the consequences by evaluating ends and means. The process is aided by watchful conduct and recognition of liabilities. Of course, there is always the *unknown*, defined as what is not known or what we chose to ignore. Yet nothing is to be treated as unknowable.

Against Gods and Humbug