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Ecological Rationality & Human Needs

Patrick Salzer

Master in Economics

Supervisor: Ana Cristina Narciso Fernandes Costa
Ph.D. Ana Costa, Assistant Professor,
ISCTE Business School, Department of Political Economy

November 2020

CIÊNCIAS SOCIAIS
E HUMANAS

BUSINESS
SCHOOL

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Resumo

O modelo de escolha racional universal em economia distorce a realidade a criar uma profecia autorrealizadora. Enquanto a disciplina economia comportamental tentou conceptualizar comportamento efetivo de indivíduos, dando uma introdução a vários conceitos filosóficos e psicológicos, a disciplina continua limitada em termos de abstrações, descrições e interpretações. O estudo presente explorou várias realidades de escolha ecologicamente racional via a análise da primeira "eco" da mente, o corpo humano, e os seus efeitos em relação à cognição e decisão. Como necessidades humanas têm sido delimitados por vários psicólogos, os efeitos cognitivos serão explorados, analisados e explicados de forma a sugerir uma relação causal entre necessidades humanas universais e valores humanos básicos. Enquanto a metodologia se baseia numa análise de dados secundários, a abordagem pragmática permite criar uma correspondência linguística entre necessidades humanas e valores humanos por vias de raciocínio abdutivo. Ao todo, necessidades humanas aparentam uma variável fundamental de racionalidade ecológica visto que não se limitam a influenciar a consciência e cognição individual, mas também aparentam afetar o bem-estar e valores individuais.

Palavras-Chave: Teoria de Escolha Racional, Economia Comportamental, Racionalidade Ecológica, Necessidades Humanas, Valores Humanos

JEL: D90, D91

Abstract

The pervasive Rational Agent Model distorts reality by creating a self-fulfilling prophecy. While behavioral economics tried to conceptualize actual behavior of individuals, giving an introduction into various philosophical and psychological aspects of rationality and human choice, it remains rather limited in terms of abstractions, descriptions and interpretations. The present research explores realms of individual ecological rationality by analyzing the first environment of the mind, the human body, and its effects on cognition and decisions. As human needs have been identified by various psychologists, the effects on the mind will be explored, described and explained in order to suggest a causal relationship between universal human needs and basic human values. While, the method of research was a secondary data analysis, a pragmatic research approach permitted a linguistical correspondence between human needs and human values via abductive reasoning. Overall, human needs seem a fundamental variable of ecological rationality as they not only influence consciousness and cognition but seem to have a tremendous effect on well-being and values.

Keywords: Rational Agent Model, Behavioral Economics, Ecological Rationality, Human Needs, Human Values

JEL: D90, D91

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Chapter 1
Introduction

Economics as a social science, that tries to predict the world like a natural science, has limited and rigid foundations regarding the fundamental parts of the macroeconomic composition, the individual. While macroeconomics can be abstracted to a living organism, each individual, business and occurrence are the fundamental components like elements, molecules and cells. As every individual action is intrinsically an economic action, even the tiniest components can have tremendous effects on the organism and will affect the aggregate arrangement in determined ways as seen for example by cancer cells. Natural science like biology do not define highly complex processes as it is the case with the definition of Life, which is rather described by its characteristics then by a simple definition, and the answers of what is alive is not always black or white as for example, certain organisms like viruses are between the shades of gray, leaving opportunity for discussion open.

The Rational Agent Model is very well-defined and the main theory regarding individual rational choice in economics. While it is able to uncover and explain determined phenomenon (like for example the Slutsky effect or the existence of different types of goods), recent research has demonstrated that the rational agent model acts in a self-prophesying way. The more economic students learn about the rational agent model and its characteristics, the more these students turn increasingly similar to the model, shown by the characteristic of self-interest, as economists seem to act in a more self-interested manner than non-economists, pointed out by the Financial Times "best book of 2017 in economics", "Doughnut Economics" from Kate Raworth.

Behavioral Economics tried to shed new light on rational choice. While bounded-rationality demonstrated how perception can alter judgement and thus, decision-making, the Nobel prize in economics in 2002 was awarded to Daniel Kahneman for his progression and challenging uncovers in relationship to the rational agent models assumptions. While progressions within behavioral economics, with the concept of the cognitive system 1 and system 2 are great heuristics to demonstrate how irrational individual mays choose, and how cognitive biases and illusions can distort the course of rational decision making, psychologist Gerd Gigerenzer demonstrated how heuristics can lead to more accurate conclusions, then integrating too much (but not all) information, arguing in favor of a "homo heuristicus" instead of the homo economicus

or homo sapiens. In 2017, economist Richard Thaler was awarded with the Nobel Prize in Economics as a result of his contribution on how “predictable irrational” individuals are, exemplified by different biases. While cognitive biases are a narrow scope within psychological theories, limited to a cognitive approach of decision-making, there is a realm of possibilities within psychology to analyze and conceptualize (behavioral, psychodynamic, biological, humanistic approaches) which could prove of interest for behavioral economic theory. The homo heuristicus provides a solid framework on how the environment affects the individual and his cognitive processes. But how do these environments differ and how do they affect cognitive processes?

For the purpose of this research I will analyze how the primary environment of human cognition, the human body affects decision-making, with the goal to advance behavioral economics, shedding new light on possible realities, and provide a basis for future investigations. In this regard, the focus and scope of this research will be broad, general and holistic in character with regards to human needs. As the Rational Agent Model, as also Cognitive Biases, have a generalizable application throughout humans, the goal is to uncover generalizable mechanisms and realities which guide choice, as the first eco of the cognition, the human body is in major terms very similar between individuals of the human species. The relevance and importance of this research are reflected in the assistance of trying to resolve a theoretical problem with practical implications, by addressing a gap in literature and shedding new light on phenomenon’s, while building on existing research in order to propose a deeper understanding of the concept of ecological rationality. As the objective is to explore new realms of scientific research and knowledge to describe and explain a part of the decision-making process based on biological, physiological and psychological factors, in order to get a pragmatic view of ecological decision-making, a qualitative methodology - a secondary data analysis and self-observation, were applied due to the interdisciplinary nature of the research problem.

The investigation will start with the literature review to contextualize the research, followed by the research methodology and a theoretical framework in order to position the following analysis. Afterwards, the results will be briefly mentioned (as the results are integrated in the analysis section), and the research will be discussed. Lastly, the conclusion section will summarize main findings, limitations and possibilities for future research.

Chapter 2
Literature Review

Individual choice is one very complex topic in economics and psychology, as the human brain is one of the most complex and mysterious structure known to humans. While the rational choice model provides a foundation on how rational choices should look like, given its assumptions, it leaves many pragmatic explanations aside. Recent economic literature criticizes the Rational Agent Model for representing a distorted image of humans, creating a self-fulfilling prophecy (Raworth, K. 2017; Robert H. Frank, Thomas D. Gilovich, Dennis T. Regan. 1996.), and emphasizing the social nature of the human species. There has been growing attention regarding behavioral economics, in its attempt to describe more realistic behavior and individual choice, subjective valuation and deviations from the "optimal" rational agent model solution. More and more recognized awards go to explorers of the subjects on decision making and behavior, with one of the most recent Nobel Prize in economics being awarded to Richard Thaler in 2017 for his insights how "predictable irrational" individuals are, exemplified by different biases. The objective of this literature review is to provide insights into the rapid evolution of decision-making theory in economics and behavioral economics and identify patterns and gaps between economics and psychology to ground my following research.

Questions about motivations, values and ultimately how and why do people choose and act as they do have travelled through the course of economic thought since its origins. The earliest classical economists like Adam Smith remarked not only the effects of self-interest with the invisible hand, but also described different sources of behavior - within his "The Theory of Moral Sentiment" (Smith, A. 1790) for example. Here, Smith analyzed and explained different sources of judgment, behavior, motivation what consequentially leads to different sources of choice. Many of these variables are incommensurable values, from so called "sympathy", what we would rather call empathy nowadays, to a common sense of fairness individuals possess and that are reflected in decisions made. Overall, Smith depicts a more pragmatic and multidimensional description of individual choice then the RAM offers, and his

behavioral analyses is still being recognized by modern scientists (Ashraf, N., Camerer, C. F., Loewenstein, G. 2005).

After the utilitarian revolution, the Economic Man, Homo Economics, and its theory of rational choice became the benchmark on how a rational choice should look like. This gold-standard model has a very solid, mathematical logically grounded basis, given the abstract assumptions he is built upon. The omniscient, self-interested homo economics maximizes his subjective utility though the allocation of capital on consumption goods, given his personal preference and the exogenous prices of the goods, maximizing thus his utility via the quantity of the good consumed. This Homo Economics is not only implausible because of his all-knowing, all-calculating mastermind, but also because of the lack of significant variables regarding individual choice. As preferences and values remain conceptual, many underlying processes of individual choice get lost in this theory. This has been highlighted by different views within social science, from economics to psychology and philosophy. While classical economists like Thorstein Veblen criticized the concept itself and denoted that individuals are not hedonic creatures who calculate their own pleasure and pain in order to maximize it (Yilmaz, F. 2007), philosophy criticizes the lack motivational and emotional content on choice, the rejection of non-commensurable variables for explanation and the inconsistencies the RAM model brings into our world, impoverishing other theories like for example the theory of the family within household. (Nussbaum, M. C. 2006) These problems have also been highlighted within by contemporary economists.

> "Deprived of a motivational content and shifted from the territory of moral indifference, utility maximization lost its original meaning, and gave rise to paradoxical conclusions with respect to social dilemmas." (Caldas, J. C., Costa, A. N., Burns, T. R. 2006)

Behavioral Economics tried to counter this mathematically grounded model, and tried to illustrate and confirm more realistic concepts of choice and judgment, what has won great attention in economics within recent years. A "more realistic" model of choice was introduced by Herbert A. Simons notion of Bounded-Rationality, in his book Models of Man Social and Rational. This model of choice depicts an imperfect agent. Instead of using all available information, or assuming the presence of asymmetric

information, agents are cognitively and time constraint, leading us to new- "satisfactory" solutions, instead of optimal solutions. Simons also introduced "heuristics" as a human pathway to solve problems. Heuristics are cognitive shortcuts, ignoring part of information to reach better inferences. As less information is used, the effort of processing information is also reduced, creating a relative benefit opposed to the usage of all available information and computation power. (Gigerenzer, g. 2004: 62-88)

The concept of Bounded Rationality was heavily deepened by Daniel Kahneman ("Maps of Bounded Rationality: Psychology for behavioral Economics",), giving new insights into the human mind, and differentiating processes of choice and judgment under uncertainty, by the so-called system 1 and 2. This not only gave a more realistic but also a much more intuitive picture of human judgment and choice.

German Psychologist Gerd Gigerenzer opened the niche of ecological rationality ("rationality" depends on the structure of environment) and deepened the niche of heuristics within behavioral economics. In various papers (Gigerenzer, G. 2003; Gigerenzer, G. 2004: 389-409; Goldstein, D. G., Gigerenzer, G. 2002) he describes cognitive processes called heuristics we use conscious and sub-consciously to make inferences every moment. These heuristics can often predict more accurately solutions then adding too much information and offer an explanation for the creation of the homo economics, as the rational agent model is a heuristic itself of much more complex processes. As we live in uncertain world, and humans tend to reduce the uncertainty by any means (natural risk aversion gave us a clear evolutionary advantage), the quantification of such an uncertain question like individual choice through the rational choice model seem like a rational choice in itself. Gigerenzer also emphasizes the necessity of explaining behavior instead of predicting it via "as-if" models as bounded rationality or rational choice did. (as-if model are hypothetical models that take people "as-if" they were rational; bounded-rational). In Gigerenzers view, people act ecologically rational, which linguistically is derived from "eco" – house and "logical" – reason and that this subjective logic depends on the environment.

The most recent noteworthy theories in behavioral economics were demonstrated by Richard Thaler, grating him the Nobel prize in economics of 2017, who showed that deviations from the rational choice model can be systematic and emerging out of different biases, like anchoring, loss aversion, endowment and availability heuristic.

By looking closely at psychological approaches used for these deviations of the rational agent model, one recognizes that mainly cognitive psychology was applied, leaving other approaches open for exploration. Cognitive psychology analyses processes around perception, memory, problem solving and "thinking" in general. Heuristics are useful in analyzing rationality given that they explain cognitive deviations from what would supposed to be the RAM solution. Some of these cognitive biases are cognitive fallacies already named by Aristoteles hundreds of years ago, e. g. The fallacy "appeal to authority" is similar to the bias "authority bias".

By examining classical theories of human behavior, namely, Plato's triparted soul, one can easily spot a clear distinction made between rationality, emotion and appetite, represented in figure 1.

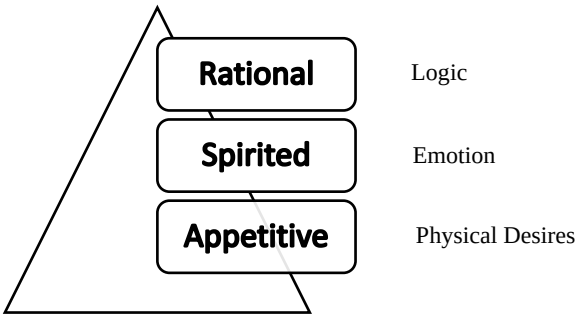

Figure 1: 3 Levels of Plato's Triparted Soul

While the difference between reason and emotions seem clear, intuitive and easily supported by recent science (Elster, J. 1996; Bechara, A., Damasio, A. R. 2005) the difference between "rational" and "appetite" does not seem so intuitive. Plato made an example with water, in which an individual is thirsty but the mind knows that the available water is poisoned. While the body, the appetite part of our mind, stives for water and wants it, given its benefits to satisfy the desire, the reasonable part of the mind knows about the poison and may not sacrifice his existence to satisfy the appetite, as the costs may be too heavy to support the benefits. In this example we see two opposing sources for behavior, a dichotomy between what Plato would call desires between different levels, and an uncertain outcome.

This dichotomy suggests different origins of behavior. Plato did no distinction between "needs" and "desires", as he used the same term in all three "parts of the soul", namely – "desires". Nowadays there is a clear separation between "human needs" and desires. While desires are unlimited and can be mere imagination, human needs have been, even

though the concept of human needs is not very precisely defined, identified and delimited by various psychologists. Notably, Plato mentioned the concept of homeostasis, as the body tries to maintain its internal equilibrium, a concept recurrently referenced in regard to human needs.

The first psychologist introducing the concept of human needs was Abraham Maslow in his pioneer work "A Theory of Human Motivation". In this heavily disputed and rather complex theory, as oversimplification distorts its logic (Compton, W. C. 2018)), motivation stems from categorized human needs. Curiously, Maslow also mentioned the concept of homeostasis while explaining human needs. Maslow ordered them into a hierarchical structure, what was greatly criticized by some psychologists (Rutledge, P. B. 2011). "Social Networks: What Maslow Misses" for example argues that social needs (which are only mentioned in the third stage in Maslow's hierarchy) are preconditions for the satisfaction of most basic needs and thus survival, as humans are a social species.

More recent theories on human needs acknowledge that human needs stem from evolutionary pressures (Lindenberg, S. 2013), which seem belong to the adaptive toolbox we humans developed through the course of evolution.

Maslow denoted that the hierarchy is not Absolut, and needs must not be to 100% percent satisfied before the next need arises. Curiously, even with the denial of the precise order, his hierarchical categorization seem to have some supporting evidence on consumption. "An overview of needs theory on consumerism (Ward, D., Lasen, M. 2009)" exhibits a European report by the food and agriculture organization, in which, as individual income rises, people tend to spent more income share in more or less the hierarchical structure. Furthermore, Louis Tay & Ed Dieners research paper "Needs and Subjective Well-Being around the World", agrees with Maslow about certain criteria like "people tend to achieve basic and safety needs before other needs." – pg. 363.

Last but not least, Delhey, J. 2009 paper "From Materialism to Post-Materialist Happiness? National Affluence and Determinants of Life satisfaction in cross-national perspective", seem to consent majorly with Abraham Maslow's theory, -if "self-actualization" is clearly defined. Human needs seem quite a promising topic of research regarding "the appetite part of the soul" of decision-making.

We have discussed a swift historical context of rational choice and its shortcomings, the quick evolution within behavioral economics, and identified a gap in literature. While

most behavioral economics focuses on bounded rationality and cognitive deviations from the benchmark model, many underlying processes of ecological rationality were left out. If ecological rationality depends on the environment, how does the first environment of human cognition, the human body, affects this rationality?
Maslow was the first introducing a theory of human motivation based on human needs. While the model has its downsides, and recent literature treats human needs, and their categories a little different, more separate from each other and less complementary (some human needs seem rather dichotomic, e. g. the need for safety and the need for novelty. While the need for safety can be translated by for example creating certain expectations, novelty is exactly the opposite, the uncertain, the not expected, the not known), the prioritization of different needs seem rather accurate, given the economic evidence on consumption patterns. The universality of human needs within our species make the concept of human needs quiet offering to research behavior, and so, our internal homeostatic equilibria, seeking optimal arousal and the drive to reduce tensions if the need is not met seem to be outstanding variables of human behavior.

Chapter 3
Methodology

What started with an exploratory research within and behavioral economics, turned to the identification of a gap in literature within the discipline, and resulted in a descriptive and explanatory research of the first habitancy of ecological rationality.
As the main research questions focus on how and why questions (how do human needs alter ecological rationality, how do they affect the primary environment of cognition - our body, and why do they seem to belong to the adaptive toolbox of humans), the chosen methodology is qualitative in nature, based on secondary data analysis. This permits a pragmatic approach in the existing ocean of information from various fields. The research method will not be limited to secondary data analysis as one key topic will also contain a little bit of self-observation, since I had the chance to observe the phenomenon in my own life for several years almost on a daily basis.

> "Economists do not have a good name. One problem is the widespread perception that economists do not 'know' or get out into the 'real world'. Doing qualitative research forced us to go into the 'real world' and discover what life is really like for domestic workers and poor Indian women engaged in informal employment. This process allowed us to both evaluate existing research in the context of our own findings and discover new data needs." (Hill, E., Meagher, G. 2006.)

As the introduced research problem is rather general in nature, as the normative and pervasive RAM explains how people should behave / what a rational choice looks like - and not how individuals actually behave, and cognitive biases can also be applied across humans but are limited to the cognitive processes related to decision-making, I wanted to research a more pragmatic and at the same time generalizable view, to find a common pattern which seem to guide ecological rationality within humans. For this reason, I chose a qualitative approach, namely, a secondary data analysis, as this research methodology permits to obtain and analyze huge amounts of data across various fields, and cross conclusions from different sources and disciplines in order to obtain a pragmatic view on the effects of human needs for ecological rationality.

Given our timeline, the age of information, and the interdisciplinary nature of choice, a secondary data analysis permitted to broaden the scope out of the classical economic thought, and discover new perspectives though philosophy, psychology, biology or physiology, while combining qualitative with quantitative research results. This methodology enables the deviation from the traditional deductive reasoning approach in research, to an abductive reasoning approach.

Abductive reasoning has the great strength to create new knowledge and advance fields with fresh perspectives, best exemplified by Darwin's theory of evolution, which is the most likely explanation of our diversified life on planet earth and constitutes a basic proposition in various fields, but cannot be deductively reached. Since my research is to address a gap in literature with a humanistic view of choice, abduction seem to be the most fitting choice of research approach. (Reichertz, J. 2005.)

One point to stack out and keep in mind is that abductive reasoning many times, as it is the case in the following research, starts by naming and analyzing individual facts across themes, which will be integrated in a consistent perspective afterwards.

Though the standard methodology within economics is usually quantitative, the phenomenological nature of human experience and human needs make a qualitative approach a better fit then quantitative testing. As economics theories have quantitative and statistical basis, much of the linguistics get lost thought numerical application. (Mccloskey, D. N. 1983.)

Furthermore, continuing to look through the scope of RAM would distort results (as bounded-rationality did), since heuristics can be more accurate then regarding more (but not all) information. To counter this (and as G. Gigerenzer suggests), a descriptive method seems more suitable.

Other methodologies weren't useful because of the lack of generalizability in quantitative testing if the study is not across cultures and time, the interdisciplinary composition of the mind and body that makes it hard to stick to a ridged methodology (as the entire research process was outstandingly iterative), and the vague definition of the concept of human needs, limiting precise measurements.

Shortcomings of this approach are that without the deductive approach, results are limited to the most likely explanations and "most likely" still leaves a window of uncertainty regarding the results. Obstacles to this perspective were, the huge amount of data, filled with novel and expert vocabulary and knowledge, outside the economic field of expertise.

In this secondary data analysis, mainly published papers and books were analyzed and referenced in order to grant high-quality and credible data. Opinions or subjective conclusions were tried to be minimized and criteria of evaluation regarding the data were adequacy; accuracy and completeness. (Sherif, V. 2018.)

Chapter 4
Theoretical Framework

Behavioural Economics can be split into these 3 major trains of thought. A line demonstrates how rational the decisions are. While the RAM is hyper rational, bounded rationality demonstrates that our perception can be limitedly rational. Ecological rationality embraces the human nature of cognitive biases and shows how irrational we may act, depending on the heuristic / bias that guide our decision.

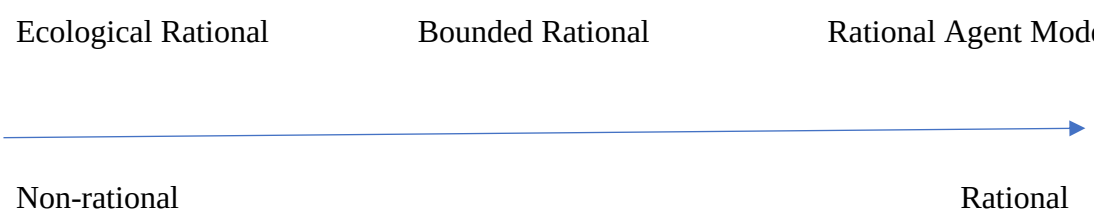

Figure 2: Unidimensional Line from non-rational to rational; with their respective trains of thought.

One basic economic principle is that economic agents, in this case individuals, produce demand through the desire to purchase goods & services and the willingness to pay for them. By splitting demand into desires and needs, instead of denominating demand as pure desires to purchase goods and services, we can have a deeper look within psychological and physiological aspects of actual human choice. While desires can be anything, from rational to irrational, tangible or unreachable, terrestrial to spiritual, human needs have been identified by various psychologists within the last century. Though economic agents can be diverse, the individual will be the main focus of this analysis. If demand, and individual choice is guided by desires and needs, is ecological rational, and needs have been identified, how do human needs shape and alter this individual ecological rationality?

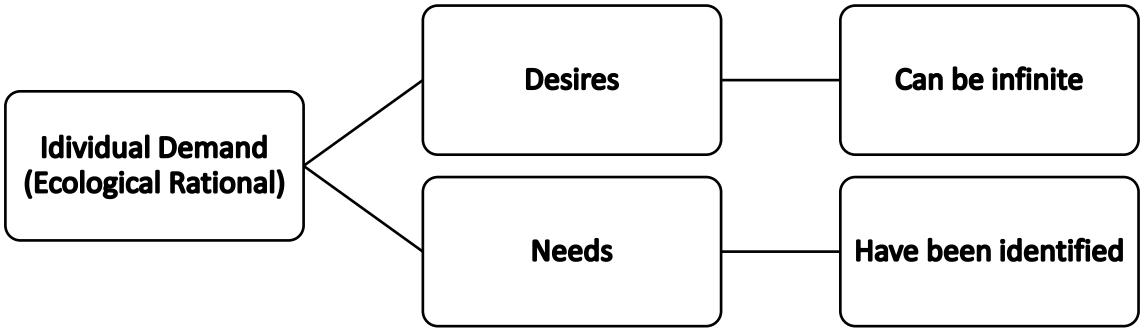

Figure 3: Splitting needs from wants

Maslow, as pioneer of humanistic psychology delimited these needs (in hierarchical structure, which means, the bottom level must be stable to build top layers). In Maslow's theory of human motivation, human needs can be separated to two distinct blocks: Physiological needs and Psychological needs.

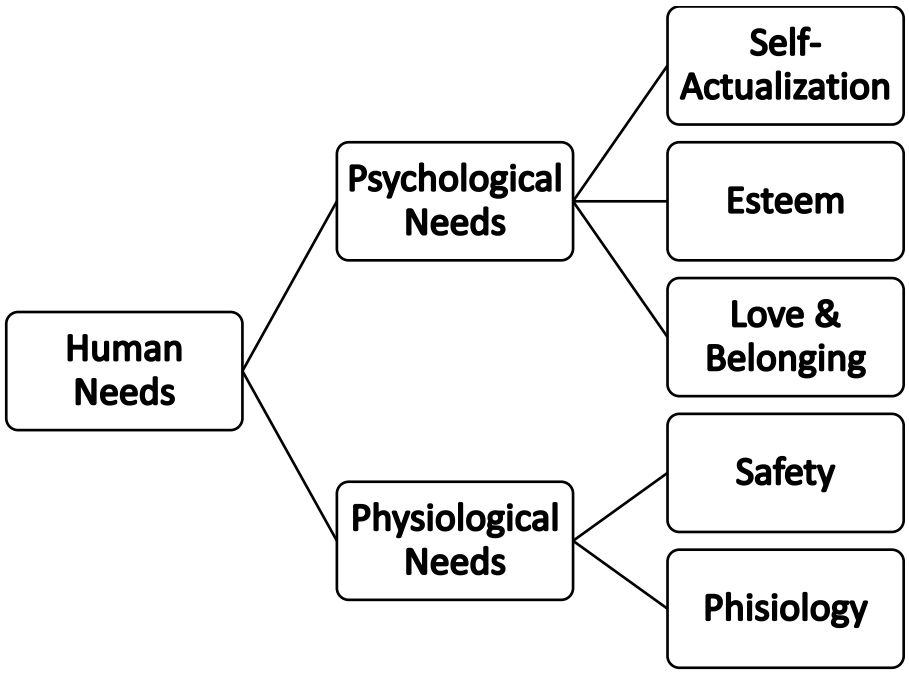

Figure 4: Decomposing Maslow's Human Needs

At the basis of this pyramid, under physiological needs, Maslow understood physiological well-being. Hereby he understood physiological well-being in terms of food, water, sex – all around health. Next comes Physiological safety, under which Maslow understood a freedom from risks and threats regarding health. (Safety must also be integrated within psychological needs as not all threats are physiological. The pure thought of a risk or a perceived threat can make individuals feel unsafe.) Under psychological needs, Maslow categorized belonging, in terms of friendship, family and a sense of connection, followed by esteem, which identifies itself through respect, self-esteem, status and recognition. At the top of the hierarchy one can fine the term "self-actualization" with which Maslow meant to" reach one's potential".
Maslow's hierarchy has been disputed and altered along time, adding 3 levels into the pyramid shaped hierarchy – transcendence; aesthetic needs and cognitive needs. Except Maslow's theory of human needs, other psychologists also hypothesized about this concept, leading to different theories with new human needs, like for example Revichs model of 3 human needs (Status; Stimulation; Security). Aside this, other needs like the need for autonomy, the need for novelty or a need for structure have been identified.

For the purpose of this research we will stick to Maslow's hierarchy of needs. Even though heavily criticized, it is a straightforward and visually appealing theory, and seems to show a basic pattern around the world, as seen by consumption patterns with regards to income level. We will look at specific examples of all levels of Maslow's human needs and explain how they alter the state of consciousness (or if it's a subconscious process, the effects of these) and thus the alteration of motivational content and decisions. At last, we will have a look at the linguistic correspondence regarding human needs and human values, both, psychological abstractions.
In order to avoid a confirmation bias, I will analyse the evolution and current state-of-the-art knowledge, theories and facts of the data and information in a pragmatic approach based on evolutionary logic, in order to represent a holistic picture of the effect of human needs on ecological rationality. Personal motivations of this research originated out of the exploration and practice of determined facts a priori, which will be explored in this chapter of the dissertation (namely, intermittent fasting and the perceived need to eat).

Chapter 5
Analysis

5.1. Human Needs, a vague definition

For Maslow, human needs built a cornerstone in motivation theory, as they drive humans into a class of determined behaviour, in order to satisfy the need. The behaviour itself can vary between individuals as local and cultural differences alter the individual self-concept. (Malsow, A. H. 1943) Motivations can be conscious or subconscious and drive behaviour to satisfy them. While other psychologists extended this idea or created new concepts regarding human needs (Alshmemri, M., Shahwan-Alk, L., Maude, P. 2017.), (Johnson, J., Irizarry, M., Nguyen, N., Maloney, P. 2018.), subsequential social science refers human needs as quoted:

> "The concept of "need" (as different from "want") is not very sharply defined, but it basically refers to the combination of finding something rewarding, being aroused to seek satisfaction, and experiencing pathological effects from deficits in satisfaction (with the last characteristic missing in wants.)" (Lindenberg, S. 2013.)

It stacks out that human needs create pathological effects if not satisfied. We as humans, have determined adaptive mechanisms developed throughout the history of evolution, which gave us the ability to adjust in all kinds of environment, and letting us become the dominant species on earth. So, what are these adaptational forces? What are the pathological repercussions of unsatisfied needs and how do they alter ecological rationality?

There are various human needs not mentioned in Maslow's hierarchy of needs, like the need for autonomy, the need for stimuli or the need for uniqueness. These will be shortly referred to in the latter part of this analysis. Brief noteworthy points about this analysis and Maslow's Hierarchy of needs are:

Human needs can be dichotomic – e.g. the need to belong vs the need for uniqueness.

Human needs must not be 100% satisfied to reach higher levels of needs – e.g. one can be hungry and feel loved.

The existence of an unsatisfied need may jeopardize needs above the unsatisfied level –

lower level needs may interfere with higher level need. E.g. the need to eat may affect financial security.

In this analysis individuals are the main focus of analysis and are synonym to economic agents, consumers and subjects.

5.2. Physiological Needs

The basis of the hierarchy are physiological needs. Under these we find, food, sleep, sex – a general state of health and physiological well-being. Health and physiological well-being are the basis of ecological rationality, as any difficulty on this level will lead to constraint decision-making. For example, physical handicaps will affect the course of individual decisions as the handicap may constraint liberty, altering the subjective ecological rationality in comparison to healthy individuals. Let's analyse different physiological needs and their effect on ecological rationality.

5.2.1. Hunger, homeostasis and altered state of consciousness

Eating is one basis for living, as consuming edibles is the main source of energy for many organisms. Humans adopted different eating habits across cultures and across the world, and have changed drastically in the last 200 years (not only through the increased demand, but also through scaling economies within food productions). Western, and many other societies adopted to eat various times a day, usually beginning with the breakfast.

One salient fact to mention is that in 2017, Cardiovascular diseases, which result from high blood-pressure; smoking; high cholesterol; inactivity; diabetes; obesity; etc… are by far the diseases with most accounted deaths in that year, almost doubling the second most deadly disease, cancer. Cardiovascular diseases seem to be highly correlated to eating and exercising habits, given its roots.

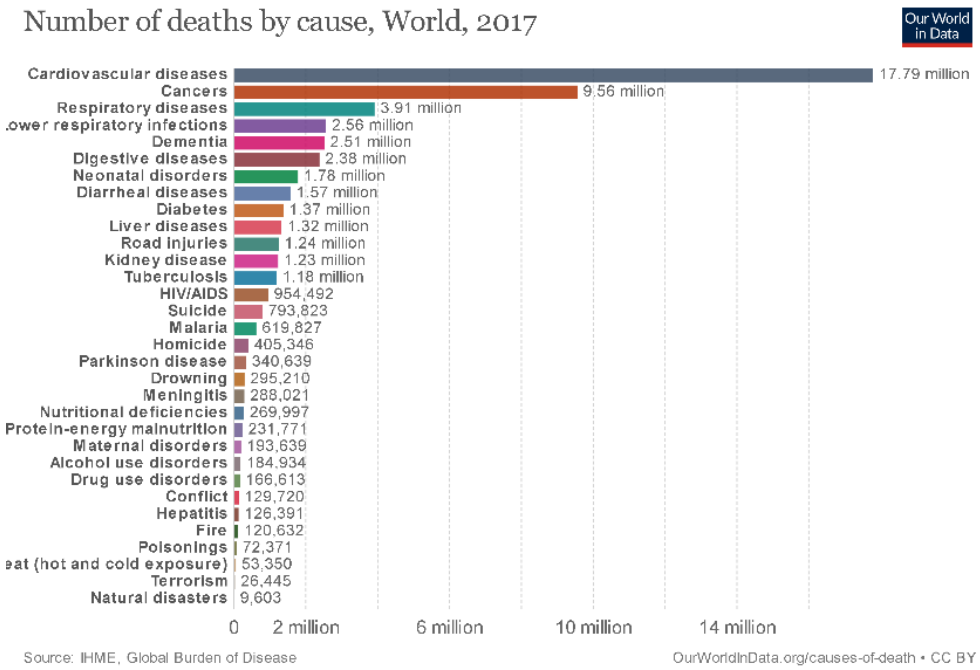

Figure 5: Number of deaths by cause in the world, data from 2017.

Source: https://www.ourworldindata.org/

Obesity is ravening in many parts of the world, especially in western societies. Some studies (based on linear predictor models) forecast that about 50% of people of developed countries will be obese within the next decade. (Findelstein, E. A., Khavjou, O. A., Thomposon, H., Trogdon, J. G., Pan, L., Sherry, B., Dietz, W. 2012.) Though the last decade was marked by healthy, biologic and organic consumption, as the year 2019 was even named the year of the vegan by “The Economist Newspaper”, weakening the real predictionary strength of the model, (as it was conducted in 2012), the energy economy of the human body seem quite intriguing. Individuals suffering from obesity for example, have more the enough energy guarded as fat reserved, but still feel the need to continue to consume external energy sources. Why and what is ecological rational in this behaviour? How does the energy economy within our body work?
In this special case I will not only look at the medical, biomechanical and physiological considerations, but also take my own experience and observation into account, as I adopted the intermittent fasting diet (with no rigid regime) several years ago, altering not only my consumption patterns, as well as my perceived need to eat.

Ghrelin is the so-called hunger hormone. Its primary function is to regulate food intake, as it indicates our body that we are hungry - a individually perceived phenomenon.

Leptin on the other hand is a hormone created by fat cells and inhibits the feeling of hunger. (Klok, M. D., Jakobsdottir, S., Drent, M. L. 2007.) Ghrelin and Leptin act antagonistic - as ghrelin rises, leptin concentrations are low, and individuals start feeling hungry, which is reversed through the consumption of food. (Abdalla, M. M. I. 2015.) When satiety kicks in, leptin levels are high and ghrelin levels are low. As food is consumed, insulin is released from the liver in order to transport the new added sugar to muscles and cells. There seem to be a correlation between insulin and ghrelin as it seems that insulin inhibits ghrelin secretion – which reverses the feeling of hunger. The most important correlation in these automatic mechanisms is that the existence of insulin within the blood inhibits the use of body fat. The enzyme hormone-sensitive lipase is utilized to mobilize stored fat as energy source, and it seems that this specific enzyme is sensitive to insulin, meaning, it loses its capacity to act. This leaves individuals, independently how much energy is available in form of fat, unable to use these reserves. In order to maintain blood glucose levels stable after several hours, the only option, as fat is not readily available, is energy from the stomach through ingestion. The body can store between 100 - 400 gram of carbohydrates (or sugar) in the muscles and about 70gram in the liver. When these energy reserves are depleted, which may take roughly around 4 hours, the body needs new (external) energy. This fundamental mechanism rationalizes the western eating pattern, starting with breakfast. (8a.m. breakfast; 12a.m. midday meal; 4.p.m. lunch; 20p.m. diner)
Another noteworthy fact is that insulin takes about 6 – 8 hours within the body to deplete (which is about what we sleep). Without free floating insulin in the bloodstream, the body is able to use up fat reserves through the enzyme hormone-sensitive lipase. It is peculiar and explanatory that the word breakfast originated from the words "breaking" and "fasting" and literally means to break the fasting period of the prior night. Breaking fasting impedes the use of body fat as energy source, leaving induvial hungry throughout the day – every time blood glucose levels drop too much.

Let us look at evolutionary terms of hunger, as the human body did not change excessively within the last couple thousand years. Evolutionarily, humans once lived in small, mobile hunter-gatherer groups and hunting and gathering were the only sources of energy. As food was less available, the human body had to endure uncertain amounts of time without food. So, our body evolved a mechanism to sustain the body during these low-energy-available times, namely gluconeogenesis and ketogenesis.

Decomposing the word gluconeogenesis, it literally means the formation of new sugar, and ketogenesis is the formation of ketone bodies (an alternate form of energy which our body may be able use). When free available glucose is fully depleted in the body, as well as insulin, the body will start breaking up fat, creating keto bodies as alternate energy source (the ketosis state is also referred to as starvation state, which attributes it perceptually with a negative connotation).

Back then, once hunter-gatherers have found something consumable, or hunted something down, the body had to ingest large amounts of food in a very short amount of time, after which, they were once again in an uncertain environment regarding energy sources. This may rationalize why stored fat cannot be used if external energy sources are available, as it increases the energy surplus and thus the available energy in uncertain environments.

Once insulin is depleted in the body, fat can be used again for gluconeogenesis and ketogenesis as energy source, reason why after waking up (with enough sleep) individuals are considered of being in the fasting state. It has been observed that insulin levels drop significantly while fasting. Blood glucose also seem to drop, but remained stable after a while, and insulin drops continuously (after a little spike on the 14 day of fasting) (Marliss, E. B., Aoki, T., Unger, R. H., Soeldner, J. S. 1970.**)**.

It would seem logical that the longer we do not eat, the hungrier we get, but research suggests that this is not the case, as fasting has shown to reduce our average ghrelin levels, and thus, our felt hunger (on a one-day study) (Natalucci, G., Riedl, S., Gleiss, A., Zidek, T., Frisch, H. 2005.). Another curiosity is that evidence suggests that the mere expectation of eating, generates a rise of ghrelin levels, (Ott, V., Friedrich, M., Zemlin, J., Lahnert, H., Schultes, B., Born, J., Hallschmid, M. 2012.), and it has been observed in rats that long term fasting (48h to 72h) reduced ghrelin anticipation, as well as a delayed ghrelin peak before the meal, and a reduced compensatory energy intake after breaking the fasting period (Zizzari, P., Hassouna, R., Longchamps, R., Epelbaum, J., Tolle, V. 2011.), which means they even ate less. Though humans seem to be a more complex species, we share fundamental mechanisms derived from natural selection with other species.

Lastly, another specific effect of fasting is an increased appetite for both high-calorie and low-calorie foods, with an increased activation of the brain reward system regarding energy dense food (Goldstone, A. P., Muhammed, K. 2009.), which means, a tendency to enjoy high calorie foods more. In evolutionary terms it would make sense to

remember energy dense food sources better then energy low food sources, especially when energy-availability is scarce.
Overall, ghrelin mediates the felt hunger and usually displays a learned pattern (based upon times we eat regulary), due the anticipatory effects. Fasting can break the anticipatory effect and decrease ghrelin levels. If we eat, insulin transports glucose, which hinders the use of fat reserved, affecting our ghrelin since we only have one energy source, through eating. By fasting, fat reserves are able to be mobilized and ghrelin levels drop, while glucose levels maintain stable.

5.2.2. Fasting and autophagy

Long-term fasting has proven to be an effective strategy to reduce obesity. While the length of the fast may vary between individuals, cases studies have proven that the body can sustain itself for over 300 days in this state (given enough amount of available body fat), as seen in a case report of 1973. (Stewart, W. K., Fleming, L. W. 1973.)
In 2016, Yoshinori Ohsumi was awarded with the Nobel Prize in physiology, for his research "Molecular Mechanisms of autophagy in yeast". Autophagy, derived from the words auto – "self" and phagy – "eating", is a fundamental process of organisms to degrade and recycle cellular components (usually unnecessary or dysfunction cells), and it is a mechanism which help maintain organism's homeostasis, by using his surplus of cellular components.
One way to activate this fundamental mechanism is through fasting (Allirezaei, M., Flynn, C. 2010.) (Martinez-Lopez, N., Tarabra, E., Toledo, M., Garcia-Macia, M. 2017.). Given a lack of endogenous energy sources, the human body uses his surplus of unnecessary and / or dysfunctional components (cells) to maintain the homeostatic state and providing enough energy to maintain life.
Autophagy has been shown to create various effects in diseases within the human body. Autophagy can be induced by reducing quantity of meals (like I personally do by intermittent fasting) – through insulin restrictions. Research even suggests that 2 meals a day without caloric restrictions can prevent metabolic syndrome without adverse health effects. (Martinez-Lopez, N., Tarabra, E., Toledo, M., Garcia-Macia, M. 2017.)

This mechanism seems to have various extensive effects on human health. While on one hand, it seem to inhibit the progression of cancer and suppresses tumours (through cell death); seem to slow neurodegenerative diseases and aging through aggregate clearance and mitochondrial preservation; prevent metabolic diseases through cell survival and energy maintenance, on the other hand, it seem to promote diseases like cardiovascular diseases (trough apoptosis), cancer and tumours through chemoresistance or tumour growth, and an increased viral replication of infectious diseases (Choi, A., Ryter, S. W. 2013.). The health effects seem quite ambiguous and need much more research in order to estimate its advantages and disadvantages.

Extraordinarily, fasting does not affect muscle masses (which evolutionary makes sense as an energy deprived organism needs enough power to hunt or gather the next energy-source in order to survive), and even seem necessary for health and muscle mass (Masiero, E., Agatea, L., Mammucari, C., Blaauw, B., Loro, E., Komatsu, M., Metzger, D., Reggiani, C., Schiaffino, S., Sandri, M. 2009.). A deep investigation of this effects is required to estimate the cost-benefits associated to fasting.

I myself, questioned the cultural bias of eating when the clock orders since young ages and started to listen to my body some years ago. Speaking from daily experience, as I adopted intermittent fasting some years ago, in a flexible regime, can tell that as long as I don’t eat any carbohydrate during the day (which means only consuming sugar-free tea ns coffee), I will not feel hungry. As soon as I consume the tiniest amount of sugar, insulin inhibits my ketogenesis and I will be hungry throughout the day, altering my eating patterns. As my body got pushed out of homeostasis, my ecological rationality gets altered, as the cognitive decision of when to eat will affect my physiology, leaving me no alternatives then to eat throughout the day, or feeling painfully hungry for some time.

Not every aspect could be included in this analysis but it gives a new light on examined phenomenon, and how physiological changes alter the subsequent the course of decisions. Though nutrition seems like a highly complex topic, as not even a perfect diet for humans has been found, in evolutionary terms and regarding most recent evidences across fields, fasting seem a tolerable and sustainable option (and possibly even beneficial) for human beings for determined amounts of time.

Overall, this topic of eating habits seems of high interest for economic behaviour and economic research, as for example, a change in the collective consciousness regarding the need to eat and fasting can majorly disrupt the demand side of the food & restauration market.

5.2.3. Addiction, dependence and impaired decision making

The notion of addiction can nowadays be considered a disease (Leshner, A. 1997.), and strikes the most profound layer of human needs, physiological well-being. Through repetition of specific behaviour, e.g. the consumption of specific substances like coffee, nicotine, alcohol and other drugs, individuals can easily become addicted. This addiction must not limit itself to the consumption of substances but can also emerge through the repetition of behaviour like playing videogames, gambling or the use of social media. In fact, the use of social media and its impact on mental health and well-being has been repeatedly subject of research in recent years. There has been increasing evidence that the use of social media can create an addiction, is linked to less self-esteem and life satisfaction (Hou, Y., Xiong, D., Jiang, T., Song, L., & Wang, Q. 2019) and that this peculiar relationship expands itself across genders and cultures (Hawi, N. S., Samaha, M. 2016.). But what is addiction?

> "When the behaviour becomes so habitual as to dominate the individual's life to the detriment of interpersonal and occupational functioning, then we have the clinical diagnosis of addiction or dependency. …. It is excessive use, the repeating over and over, far beyond the point of actual need, that gets us into the addictive pattern," (Metzner, R. 1994.)

Far beyond the actual need, through repetitive consumption within determined limits of time, that is how Ralph Metzner describes addiction. The extended use of addictive substances can easily create tolerance, (tolerance as adaptations within body and brain due to exposure), which in turn leads to increased consumption, only to perceive the same effect as before the tolerance. This can also be seen by obese individuals regarding food cues, as eating can also be a disorder and lead to an addiction. (Goldstone, A. P., Muhammed, K. 2009.) What are the mechanisms that drive individuals to this this

pathological behaviour? Investigations indicate that addictive substances activate the natural reward system in the brain, a key component of learning, which in evolutionary terms emerged to indicate beneficial behaviour and assured repetition of this beneficial behaviour (for example, consuming calorie intensive foods, before the agricultural evolution when edibles where scarce). The use of the addictive substance activates the same reward systems in the brain as intense natural rewards, and the positive feedback through endorphins are a key component of learning. Frequent drug exposure can alter the quantitative scaling of some rewards, distort normal reward processes and induce new brain processes like an aversion to a withdrawal state (Kelley, A. E., Berridge, K. C. 2002), altering the normal functioning of the brain.

Cognitively, cues pay an important role in addiction and addictive behaviour, and they may be external and internal (Siegel, S. 2005**.).** Addicted individuals may be aware of the cues – even thou they may be subconsciously processed. In altered minds of dependant individuals, cues can surge out of nowhere, be processed subconsciously and create pathological effects like cravings and/or withdrawal symptoms within the individual. Addicted individuals have physiological changes in the brain via altered pathways which may lead to different decision-making. It has also been observed that drug exposure impairs the orbitofrontal cortex - region of the brain involved in cognitive processes and decision-making. (Schoenebaum, G., Shaham, Y. 2008). Addiction can have physiological effects, psychological effects or both during the withdrawal state, depending on the origin of the dependence, as different addictive substances have different features, but all are linked to compulsive behaviour, as it impairs the normal functioning of the individual. This has great effects on rationality, as Graham Oddie describes:

> "Perhaps, then, we should look at some richer concept of autonomy. If autonomy, or at least valuable autonomy, involves rationality as well as choice, then one might argue that the addict has lost at least something of value in losing autonomy. For once addicted it is no longer reason which drives his action, but rather raw desire" (Oddie, G. 1993.)

A raw desire or a perceived need? The effects of this compulsive behaviour and impairment in the decision-making process, through a loss of autonomy, can explain

why new information does not alter the addictive behaviour in dependant individuals, as Heyman G. M. has shown in his investigation regarding smokers (Heyman, G. M. 2003.). In this research, new information regarding the negative health effects of smoking does did not affect behaviour, even though information should alter adaptive behaviour to benefit the organism in the short- and long-run.
Though addiction might seem like an abstract concept, given its changeable properties, the universal mechanisms of the natural reward system that drive addiction are present within the human species. Addiction alter the mind and physiology of individuals and, and the aversion to the withdrawal / seeking the arousal state seem key, altering decisions, behaviours and outcomes.

In economic terms, addiction and addictive substances seem of high interest. Not only to understand consequences or to understand on how to nudge a desired behaviour; but also, e.g., to analyse the phenomenon per se. For example, drugs can be a quasi-linear goods due the compulsive behaviour associated to addiction, which means the price won't affect significantly the quantity demanded. If now restrictions are imposed, tightening the illegal market and shifting the supply curve, addicts simply have to pay a higher price, but this will not stop the compulsive behaviour and the consumption, leaving addicted individuals worse of then before the restrictions (as they pay higher prices for the same amount; and given the tolerance effect, they may have to buy more quantity for the same perceived effect, leaving them even worse off.)
Another interesting point for economics could be for example, and especially with regards to videogame or social media addictions, the loss of productivity associated with it. As individuals waste hours per day and week in satisfying the created need, there is a huge cost of opportunity, as the same time could have been used to create or produce something instead of merely consuming.

5.2.4. Sleep deprivation and an altered state of consciousness

Though this topic seems intuitive, given the self-experience of sleep deprivation or bad sleep, numerous studies have shown the cognitive impairment caused by a lack of sleep. Sleep is an indispensable need in all animals (with exception to a few basal animals that have no, or a very simply brain, like a sponge or a coral), and can be characterized by an altered state of consciousness with different sub-states. Within humans, sleep has

various functions, ranging from tissue repairment to memory consolidation, (Walker, M. P. 2009.) and sleep deprivation seem to be linked to impaired cognitive functioning (Alhola, P., Polo-Kantola, P. 2007.).

Sleep deprived individuals exhibit a higher sleepiness, a deterioration in attention, working memory, executive functions and decreased positive mood, which persists after following recovery nights for the reason of the so-called “sleep debt”. (Lo, J. C., Ong, J. L., Leong, R. L.F., Gooley, J. J., Chee, M. W. L. 2016.)

The need to sleep is essential for human beings, but the quantity of hours to satisfy this need is determined by a variety of factors like age, genetic features, or behavioural and environmental factors (Chaput, J.P., Dutil, C., Sampasa-Kanyinga, H. 2018), which leads to a variety of optimal hours of sleep between individuals.

Health effects of sleep deprivation seem to be diverse, reaching from cognitive to physiological changes. Cognitively, a lack of sleep can lead to decreased performance and decreased mood and attention. Physiologically a lack of sleep can contribute to obesity, a lack of balance and a higher proneness of injuries (due a lack of attention) (Chaput, J. P., Dutil, C. 2016.) (Killgore, W. D. S., Weber, M. 2014.). As sleep is considered an altered state of consciousness, a lack of sleep also seems to alter consciousness from rested individuals, as awareness, alertness and responsiveness deteriorate, leaving sleep deprived subjects less conscious then rested individuals.

5.3. Safety Needs

Safety is a broad concept, and it characterizes itself by a lack of risk – protected from harm and undesirable outcomes. In individuals, the lack of risk is usually with regards to the physiological, political and financial dimensions. A lack of safety in turn, characterizes itself by: not being able to control the situation or not being able to predict the outcome (as by predicting the outcome one can backwards induce a safe strategy). The concept of safety is highly linked to the concept of certainty, as uncertainty creates unknown outcomes. Thou we live in a relatively uncertain world, humans try to create as much certainty as possible, in order to secure this need, evidenced by, for example laws, structures, institutions, paper and digital money, or the Rational Agent Model in-itself, as it tries heuristically to explain and predict how rational choices look like, in an attempt to satisfy this need for safety.

If safety is not met, either through perceived or real threats, the typical response is stress (Geller, E. S. 2016.). Stress is a physiological response, evolved evolutionary to ensure survival of the organism (Lupien, S. J., Raymond, C., Juster, R. P., Marin, M. F. 2018.), and its effects have been subject of research in a variety of disciplines and ways. Physiologically, when a stimulus (usually external; but determined thoughts can be an internal stimulus of stress) causes stress in an individual, the hypothalamic–pituitary–adrenal axis (a complex set of interactions between the hypothalamus, the pituary gland and the andadrenal glands) get triggered and the body releases cortisol from the adrenal gland. This has various physiological effects like for example an increase the blood sugar level (through gluconeogenesis; and inhibits the peripheral use of glucose), a suppression of the immune system or a release of free amino acids. Walter Cannon, a precursor on stress research, linked the concept of homeostasis with stress and stress responses, arguing that, as stress releases adrenaline, the bodily homeostasis got pushed out of equilibrium.

> "…. Cannon (1929) proposed that the release of adrenalin (i.e., epinephrine) into the bloodstream has several adaptive functions that allow an organism to respond to an acute stressor by preparing it to "fight" or to take "flight"." (Robinson, A. M. 2018.)

5.3.1. The fight or flight response

The so called “fight or flight response” has been observed in all kind of mammals and seem to be an evolutionary adaptive force to ensure the survival of the organism. While under acute stress, the sympathetic nervous system gets turned on, dilating pupils (to increase vision); inhibiting salivation and digestion (as it is no time to eat or rest), relaxing the airways and increases the heartbeat (to ensure oxygenation of the muscles), freeing amino acids and increasing the blood sugar (to provide extra energy), preparing the body either to fight or to flight. It is proposed that emotional responses with regards to the stressor are a key variable to determine the response to fight or flight, where anger activates a fight response and fear the flight response. (Zheng, Z., Gu, S., Lei, Y., Lu, S., Wang, W., Li, Y., Wang, F. 2016)

Stressful stimuli can be real threats or merely perceived threats by individuals (e.g. having to face a lion vs having to face a superior) and can be acute or chronic. In cases were the stressful stimulus prolongs itself, and stress stretches itself over the long-term, it can leave the affected organism chronically stressed (Davies, K. J. A., 2016.). Chronic stress has been linked to various diseases and mental disorders. Investigations suggest a link between stress and depression, stress and cardiovascular disease (which was the nr^{o}. 1 killer of 2017) and even stress and cancer (Cohen, S., Janicki-Deverts, D., Miller, G. E. 2007.), which lets us suggest that this is no desirable state of being. Furthermore, there has been some evidence suggesting that stress causes various effects on cognition, altering the state of mind.

5.3.2. Stress and cognitive function

Stress can have ambiguous effects. Some research demonstrates how high stress in difficult tasks can leave the subject impaired, while high stress in easy tasks improve the overall performance (Sandi, C. 2013.). As the difficulty level of determined tasks depend on the individual skill level with regards to the task at hand, it is curious that highly skilled individuals perform better under stress, and low skilled individuals are left impaired. This result seems congruent with the flow theory, as high skill, high challenge leaves subjects within the “flow zone”, while low skill in high challenging tasks leave the subject anxious.

Stress seem to be related to anxiety, affecting the amygdala (a highly malleable part of the human brain in terms of neuroplasticity), which in turn can result in pathological consequences like anxiety disorders or post-traumatic-stress-syndrome, (Roozendaal B, McEwen BS, Chattarji S. 2009.) and may lead to riskier decision-making (Pabst, S., Brand, M., Wolf, O. T. 2013). It is a common persuasion technique to time constrain decisions and create a sense of scarcity with the intention to produce stress in order to manipulate behaviour.

The variables that influence stress are highly subjective in nature which makes the phenomenological experience extremely variable in potential outcomes. While some individuals may be stressed by time or certain cues (e.g. facial expression cues), others may be affected thought financial instability or interpersonal threats (real or perceived). The fight or flight response is not always available when it comes to interpersonal stress, so individuals adapted coping mechanism to reduce this interpersonal stress, for example through power & subordination (Gilbert, P., 1993.), which will be discussed further in the fourth topic - esteem needs.

5.3.3. Financial insecurity and stress

While a systematic review of cortisol studies in 2016 could not find the link between unemployment and stress, and emphasizes the existing problem regarding the methodological and conceptual approaches on measuring the effects of unemployment on stress levels (Sumner, R. C., Gallagher, S. 2016.), other studies have suggested a relationship between cortisol levels and the fact of being unemployed, since a lack of income is the basis of financial insecurity (Linn, M. W., Sandifer, R., Stein, S. 1985.; Ockensfels, M. C., Porter, L. S., Smyth, JM., Kirschbaum, C. 1994.), and may jeopardize physiological well-being in the long-run.
It also has been observed that cortisol levels in unemployed where high during the morning hours, and low at night, which employed people displayed the opposite way., low stress during the morning and high cortisol levels at night (Ockensfels, M. C., Porter, L. S., Smyth, JM., Kirschbaum, C. 1994.) – demonstrating only one of many methodological problems regarding the quantitative testing of this hypothesis, as only one measurement per day would leave the results incomplete and lead to wrong

conclusions. Individual differences on perception and coping mechanisms hinder further a standardized methodological approach; and clear corroboration of the adverse effects produced by stress as a result of unemployment.

> **“**It is evident that poverty and mental ill health are linked together in a complex manner. Insecurity, low educational levels, inadequate housing and malnutrition, which are the correlates of poverty, are recognized as contributing to common mental disorders.” (Kuruvilla, A., Jacob, K. S. 2007.)

Though the direct relationship between stress and financial insecurity seems ambiguous and needs deeper investigation, it would make sense that financial insecurity seems detrimental for physiological and mental well-being.
Stress also seem to be of high interest for economics with regards to individual behaviour. Though the concept may be highly subjective and must not be objectively real (as perceived threats can be mere misinterpretation), the effects of stress and especially chronic stress seem adverse for physical and mental well-being. As each individual cope with his stressful stimuli, this concept may also be of high value to self-reflect about situational responses.

5.4. Love and belonging needs

Humans have evolved as social animals, as living in groups provided us protection and dominance within nature. Through the history of time, evolutionary forces have shaped humans into social beings, as living in groups not only gave humans reproductive opportunities (which the human species cannot meet alone), but also protection and safety, and increased their dominance as humans were able to hunt down larger prey then themselves. Through mirror neurons and empathy, we created bonds and build trust, which in turn permitted the division of labour and specialization. Nowadays we still have the biological markers of evolution, through the deep-rooted need to belong, as it ensured survival of the individual, back when we were small, mobile, hunter gatherer groups. Back then, being isolated or rejected by the group was most probably a death sentence for an individual, so adaptations occurred to ensure survival, perceptible through the feeling of pain when being rejected (Kross, E., Berman, M. G., Mischel, W., Smith, E. E., Wager, T. D. 2011). If a given individual behaviour was not accepted by the group, rejection and the felt pain associated to the rejection, was a great indicator of the standing within the group and the need to change this behaviour in order to remain within it, even without sophisticated linguistical knowledge to describe the misconduct.

> "As far as the brain is concerned, a broken heart may not be so different from a broken arm." (Weir, K. 2012.**)**

Though this introductory quote may seem euphemized, the exist of physiological markers in the brain has been observed, as certain regions get activated through pain. It has also been observed that different regions of the brain are activated when feeling social pain or physical pain. (Woo, C. W., Koban, L., Kross, E., Lindquist, M. A., Banich, M. T., Ruzic, L., Andrews-Hanna, J. R., Wager, T. D. 2014.)

5.4.1. Social belonging and altered behaviour

The need to belong is still a fundamental and pervasive individual motivation, which highly varies among subjects and contexts and will oscillate on the context and

environment (Baumeister, R. F., Leary, M. R. 1995.). The need to belong can express itself in various ways, where behavioural contagion seems to be one form of expression of this fundamental human need.

Social, or behavioural contagion is a phenomenon where individual decisions, opinions and behaviour get guided through the social contacts an individual has (Ugander, J., Backstrom, L., Marlow, C., Kleinber, J. 2012.). While the direct source of social contagion is still debated (if humans strive towards convergence, consciously through norms and rules; or if individuals can converge into clustered out of shared individual motivations) (Christakis, N., Fowler, J. H. 2013.), it seems like a fundamental transmitter of beliefs, emotions and behaviour.

Another expression of the need to belong can be observed through the "Groupthinking" phenomenon. Groupthinking, as the name suggests, occurs within groups and can lead to irrational / dysfunctional decision-making which would not be made on an individual level. It occurs when a desire for harmony, conformity and cohesiveness overpowers individual autonomy and thinking capacity and various symptoms have been identified. (Janis, I. L. 1971.) As individuals may believe in an inherent morality of the group, self-censors the own opinion and collectively rationalize decisions, flawed decisions, like the Space Shuttle Challenger disaster, may occur (Janis, I. L. 1991.), which fundamentally could have been avoided.

5.4.2. Social rejection and altered consciousness

As described before, social rejection to misconduct altered behaviour in small groups, as autonomy got lost and free decision-making was impaired. This seem to have had its evolutionary benefits as individual selfishness got looked down upon and we became more empathetic and social. There are various forms to cope with rejection, from adaptation to avoidance - which exact coping mechanism is applied in which situation will highly vary on the individual (Mallor, M. A., Maner, J. K., DeWall, N., Schmidt, N. B. 2009.), of the cause of the rejection and the level of proximity to the rejector. Various observations regarding rejected individuals have been made during the last two decades. It seems that anxious individuals may exhibit "negative coping mechanisms" (avoidance, aggression, and internalizing behaviours), and non-anxious individuals may manifest positive coping mechanisms (reappraisal or problem-solving). It also seems

that rejection leads to diminished self-esteem (DeWall, C. N., Bushman, B. J. 2011.), which makes logical sense, if a certain behaviour is rejected, the belief of rewarding self-direction is jeopardized, may leading to a loss of autonomy and impaired individual decision making.

Another curious point is that socially rejected individuals seem to be less aware of themselves (probably to cope with rejection and distress) and more aware of the behaviour of others. It is proposed that this awareness shift (or shift in consciousness) is a strategy to protect the self and regaining / maintaining the social relationship to the rejector. (Hess, Y. D., Pickett, C. L. 2010.). Furthermore, it has been observed that rejected individuals are less cooperative, donate less money, are unwilling to volunteer, all behaviour linked to the 3 level of Maslow's hierarchy (Baumeister, J. M., DeWall, R. F., Ciarocco, C. N., Bartels, N., Michael, J. 2007.), so they seem less interested in being socially accepted and less caring about others. On the other hand, individuals who have a stronger need to belong, have a higher social perception skill regarding social cues (Pickett, C., Gardner, W. L., Knowles, M. 2004.), making them more likely to spot cues and adapt their behaviour.

Lastly, research suggests that the direct impact of being rejected is an impairment of self-regulation and intelligent thought. (Baumeister, R., Brewer, L. E., Tice, D., Twenge, J. M. 2007.), giving only some dimensions of the effect's rejection can have on cognition and behaviour.

In 2008, John T. Carpaccio from the University of Chicago published his book about loneliness. Loneliness is not the same as being alone, but rather a felt phenomenon of not belonging to a community or being understood or valued, which seem like an unsatisfied need to belong. This book discloses the detrimental effects on physiological and psychological health, an unsatisfied need to belong may be accompanied with. These effects range from an acceleration in aging or Alzheimer's disease, to psychological adversities like isolation and depression. (Carpaccio, J. T. 2008.)

A lack of or an inability of the need to belong is highly associated with various mental disorders (Shifron, R. 2010.**)**. A lack of this need can be seen in can lead to social anhedonia and social anxiety (Brown, L. H., Siliva, P. J., Myin-Germeys, I., Kwapil, T. R. 2007.), and it seems that determined mental disorders like e.g. Borderline personality disorder leave individuals more sensitive to rejection (Staebler, K., Helbing, E., Rosenbach, C., Renneberg, B. 2011.). Overall, the lack of the need to belong is

comparable to various symptoms categorised by the DSM-5 of the WHO, with special regards to personality disorders like antisocial (lack of empathy; lack of remorse); avoidant (rejection sensitive); and other psychopathic disorders (lack of socialization).

For economics, the need to belong is crucial for diverse aspects of a functioning economy. Either through the need to belong to a certain business, which may affect certain behaviour, like e.g. driving conformity, to the existence of trade unions in specific labour markets in order to defend individual rights (usually with regards lower (physiological) level needs like financial retribution or labour conditions). It seems also quite interesting in macroeconomic terms, as societal unions create bigger and more dominant structures in order to gain / maintain power over resources, which will be discussed in the next topic.

5.5. Esteem needs

Esteem needs come in a variety of forms, like feeling respected and recognized, or possessing self-confidence (at least enough to speak up and believe in oneself), which in major terms can be translated to feeling accepted and valued by others. Maslow put this level of need above the need to belong, as without social support, individuals can only feel valued from themselves.
In Maslow's era, the theory of social dominance was not published (as the theory was only released in the 1990s) but there seem qualitative correspondences between Maslow's esteem needs and the social dominance theory.

5.5.1. The Social Dominance Hierarchy

The social dominance hierarchy describes the hierarchical structure within group settings. Every individual experience uncountable dominance hierarchies across time and space, where each group setting constitutes an individual dominance hierarchy (with the respective top and bottom). In evolutionary terms, this hierarchy seem to have emerged out of beneficial reasons across social species. As social species live in group settings and share limited resources like food, space or reproductive opportunities, the social dominance hierarchy created structure within the group without the necessity of fighting each time a conflict of interest emerged, as the costs on health and energy would have been immense for this species.
Socially dominant individuals, on the top of the hierarchy, have privileged access to resources, while the lower class individuals subordinate themselves. In evolutionary terms, and in line with Darwin's survival of the fittest, this ensured the reproduction of the most dominant organisms to pass on their genetic compound, while diminishing inferior gene transmission.
Markers of dominance (which subconsciously persist nowadays) where physical cues like the age, size, posture (Schwartz, B., Tesser, A. 1982.), that estimated the cost of a potential fight. It has also been observed that the mere body-language and posture alter dominance perception. While an open and vulnerable position (elevation) signals dominance, a lower posture like sitting or turning the back signals less dominance (which can be observed in various animal behaviours, like dogs placing their tails between the legs when scared). There also seem a significant difference between sexes

regarding this hierarchy, as it is suggested that men asses the hierarchy in a different, more important way then female.

Linking the concept of esteem with the concept of social dominance, it seems like and implication that social dominant individuals display higher self-confidence and an increased feeling of being respected by others, while individuals lower in the social dominance hierarchy subordinate themselves, to reduce stress of potential fights. While evolutionary, physical strength was once the gold standard of dominance, we humans with our complex and intelligent brain switched from an uncertain environment to a relatively safe environment. Given the human skill to create tools and weapons, and as threats where brute force was necessary for survival diminished, the social dominance hierarchy shifted to a social competence hierarchy, where intelligence, capability and expertise became the markers of dominance and potential. With the alteration of the environment to an industrialized, monetary economy, these markers shifted to wealth. Wealth is perceived as an indicator of success and competence, and it is a cause of social dominance, as it permits individuals to employ people, to control resources like space and to be able to alter behaviour and force compliance in subordinates (Cheng, J. T., Tracy, J. L. 2013.). Nowadays, the invisible dominance hierarchies still seem to persist. Investigations suggest that males still are more prone to be social dominance orientated (and social dominance orientation seem to be negatively correlated with empathy, tolerance, communality and altruism) (Pratto, F., Sidanius, J., Satllworth, L. M., Malle, B. F. 1994.), evidence suggests that while socially dominant individuals try to maintain the hierarchy, low socially dominant individuals try to dismantle it (Sidanius, J., Pratto, F., Mitchell, M. 1994.**)**. It has also been argued that there is a difference between social dominance and social prestige. (Maner, J. K. 2017) While both consider top tier status within the hierarchy, dominance is about to force subordinate behaviour and prestige is about creating value for a community.

Curiously, being high in the social dominance hierarchy is correlated to higher glucocorticoid levels (or in other terms, higher stress levels) (Creel, S. 2001.), which could be originated by the stress of defending the top position in the hierarchy from peers, as well as protecting the group from threats. Low social hierarchy position on the other hand seems to promote depression, which is suggested to arise partially through emotion suppression (Langner, C. A., Epel, E. S., Matthews, K. A., Moskowitz, J. T., Adler, N. E. 2012.

5.5.2. Social dominance and behaviour

Now that we understood the social dominance hierarchy, and its evolutionary role of "survival of the fittest" while maintaining group coercion, how does it affect ecological rationality and thus behaviour?
Again, subordinate individuals' loose autonomy though conformity. As said earlier – dominant individuals are more prone to get what they want. They have privileged access to resources, like monetary resources, and are thus able to control resources, and alter behaviour of subordinates. An employer, employee relationship is the best example, as subordination from the employee is fundamental for the relationship to work. As employers can force compliance by demanding employees to adopt certain behaviour in order to pay them afterwards, autonomy got diminished, once again, and ecological choice got constraint, may leading to a form of group thinking.

In economic terms, the social dominance hierarchy seem of great interest to analyse the existing corporations and competitions in all layers of societies. Not only a to analyse different situations (like in game theory) where not only information is a key variable, but the position on the hierarchy, as markets for example have market leaders who want to safeguard the advantageous dominant position, but also to reflect about acquisitions and fusions for example. As market leaders can backwards induce moves to stay ahead of the competition and live in a competitive environment, dominance may exhibit itself through weakening the enemy, while prestige is progressing the industry by innovation and new technologies, and staying ahead because of the societal benefits they create.

5.6. Self-actualization

The concept of self-actualization seems like a metaphysical concept, but it has been studied in various ways during the last decades and the postulation is predominantly about "reaching one's potential". Though the definition of this concept has been interpreted in various ways, it seems like the peak of humanistic thought. But, what does it mean to self-actualize and how is it achieved?
While the clear definition of self-actualization can be disputed, as it has been in recent years, as for example self-actualization needs a certain level of openness, one of the big

five personality traits, since lack of openness hinders imagination and liberalism regarding ideas, values and beliefs (Mittelman, W. 1991.), the abstraction is about reaching one's potential, which in Maslow's definition was classified by certain sub-traits like: creativity, spontaneity, problem solving, a lack of prejudice and the acceptance of facts. When all other needs are met, especially esteem needs, and the goal is not to enhance one's status (dominance) but rather to create something impactful, either through time, which will remain when one is gone, or through the practical application of problem solving regarding e.g. other people. (O`Connor, D., Yballe, L. 2007.)
Following psychologists extended the hierarchy, adding a new layer on top of self-actualization, self-transcendence, which composes itself by the seeking of meaning in the individual life (Greene, L., Burke, G. 2007.). The phenomenology of meaning is quite complex, but there are several markers which indicate a subjective "meaningful action" which are also highly congruent with the flow theory (e.g. intense focus; a distortion of temporal perception; a loss of self-consciousness; a autotelic experience). As every human creates his own meaning and purpose in life based upon his perceptions and beliefs, self-transcendence involves the surpassing of the decay of the tangible composition which constitutes the self.

The concept of potential is fundamental within economic theory. Either through potential GDP or potential outcomes, it is the end point of a given timeframe where something could be and there is usually a difference between the actual and potential end point. As the human life is continuous, each endpoint will be the beginning of a new point, with newer potentials, which makes the concept highly dynamic.
Looking through an economic scope, an individual, sometimes called human capital, is the biggest potential for economic growth. While many macroeconomic theories regard technology as main engine for exiting a steady-state and creating economic growth, the basis of technology and technological progress is by human hand. This has been acknowledged and published by the Nobel-prize winning economist Joseph Stieglitz in recent years in his books "The price of inequality", which states how inequality hinders economic growth by reducing individual opportunities and thus limiting potential, and "Creating a learning society", which proclaims that wasting human potential jeopardizes the potential of economic growth. (Stieglitz, J. E. 2012; Stieglitz, J. E. 2015)

In evolutionary terms this problem-solving, creative state seem to be associated to the development and adaptive forces humans possess. It was the creation of tools, clothes and weapons, preserving food and dominating the elements, which gave humans a clear competitive advantage regarding natures dangers, offering them adaptive powers beyond biological compositions, permitting him to become the dominant species of the earth and shaper of materiality.

What does self-actualization look like and why do we need to self-actualize? If it is not achieved, are there repercussions?
Alexander Fleming and his co-workers are one example of prestige seeking, transcendental self-actualization. Alexander Fleming unintentionally discovered penicillin, the precursor and leader of anti-biotics. He and his co-worker Howard Florey did not want patent the substance, after the third co-worker, Ernest Chai, asked to patent it, as I quote:

> "the discovery was for the benefit for mankind – that it was immoral to seek patent protection." (Bennet, J. W., Chung, K. T., 2001.)

The discovery of penicillin could have been highly profitable if the intention was to patent it and get financially wealthier and becoming socially more dominant, but the scientists restrained from patenting. They wanted to offer a cheap medication throughout the world for everyone who needed it. This seems to demonstrates the zenith of humanistic thought within these scientists where benevolence and caring reign. But why do we need to self-actualize?

Investigation suggests that individual perception on self-actualization have functional motives behind the transcendental view. Individuals seem often to regard motives of self-actualization in order to gain status and esteem, and they perceive that self-actualization is linked to status and esteem. (Krems, J. A., Kendrick, D. T., Need, R. 2017.)
But there also seem intangible motives which drive the need to self-actualize. We humans have attributed meaning and purpose to all species ranging from insects to reptiles to fish to mammals. As each species, adapted through natural selection, plays a fundamental role in the ecosystem (bees as pollinators; snakes as pest control;

earthworms as soil loosener or vultures as leftover recyclers) and the human species, adapted to many environments around the globe, do not fit exactly within the reasoning of a purpose-based ecosystem, which given every human the ability to create his own meaning and purpose within his ethos. There are various ways to create a sense of meaning and purpose within the individual life, and one of them is to extend the self across space and time, either through inventions; creations; explorations; ideas; art; which will remain once life fades. (Karlsson, N., Loewenstein, G., McCafferty, J. 2004.) It seems to be fundamental to have a sense of meaning, intrinsic values and a transcendent perspective for human spiritual well-being (Westgate, C. E., 1996.) and transcendent factors like, creating something durable, which remains once our own life has vanished from the face of the earth – seem a way to self-actualize and to achieve transcendence.

There seem no direct repercussions of not satisfying self-actualization (as self-actualization in itself is an abstract and individual notion and a simple task can mean to self-actualize, depending on the self), but investigations have found some interesting correlations. Self-actualization seem to be correlated negatively with depression and stress, and positively with the awareness and clarity of one's own self-concept. Self-actualizing individuals seem to be less prone to depression and high in esteem (Treadgold, R. J. 1999.). At the same time, it is suggested that self-actualization leaves individuals less prone to boredom (McLeod, C. R., Vodanovich, S. J., 1991.) (in congruence with flow theory). It has also been observed that individuals with a high entrepreneurial drive utilize their business to increase their self-esteem and to achieve self-actualization; while individuals with a low entrepreneurial drive seek financial security through their business (Carland, J. W., Carnalnd, J. A. C., Carland. 1995.), demonstrating different layers of Maslow's hierarchy

Developed countries shifted from survival and security needs to higher level needs (Tischler, L. 1999.), giving an explanation for post materialistic shifts within societies. As individuals trust that lower level needs will be met, they explore higher needs, bringing new ways of thought, change and innovation. While some scientists argue positively that the Post materialistic shifts in societies are caused by the satisfaction of basic needs (Inglehart, R., Abramson, P. R. 1994.), other argue normatively that societies should switch from wealth as a goal to self-actualization as a good, as it would

secure high personal welfare and collective sustainability (Murtaza, N. 2011.), what seems quite offering given the global problems humans are facing today.

5.7. Human needs and human values

Until now, we have analysed and described how different human needs affect ecological rationality and behaviour in various ways, and we have seen that the expected effects on need in-satisfaction vary highly on the individual. As phenomenology attempts to zone out objective mechanisms within subjective realms, we have described, analysed and explained how evolutionary adapted human needs alter the course of individual ecological rationality.
Though Maslow's theory describes human needs, it is titled "A theory of human motivation", and thus, its purpose is to describe how human needs alter motivational content of action. Schwartz theory of universal human values seem to have a high linguistical correspondence to the theory of human needs. As human motivations change, behaviour changes and thus underlying values should alter themselves. Let us have a look on the linguistical correspondence of these two theories and the possibility of comparability and correspondance, which would need further investigation.

Schwartz theory was published in 1992 and it displays universal values all humans across cultures detain. A noteworthy point is that opposing sides have a dichotomic character: security vs openness; transcends vs enhancement; humility vs hedonism. In 2012, a refined theory of values was published by Schwartz, digging deeper into universal values and their sub-values. For the purpose of this analysis, let us look at the refined theory of human values.

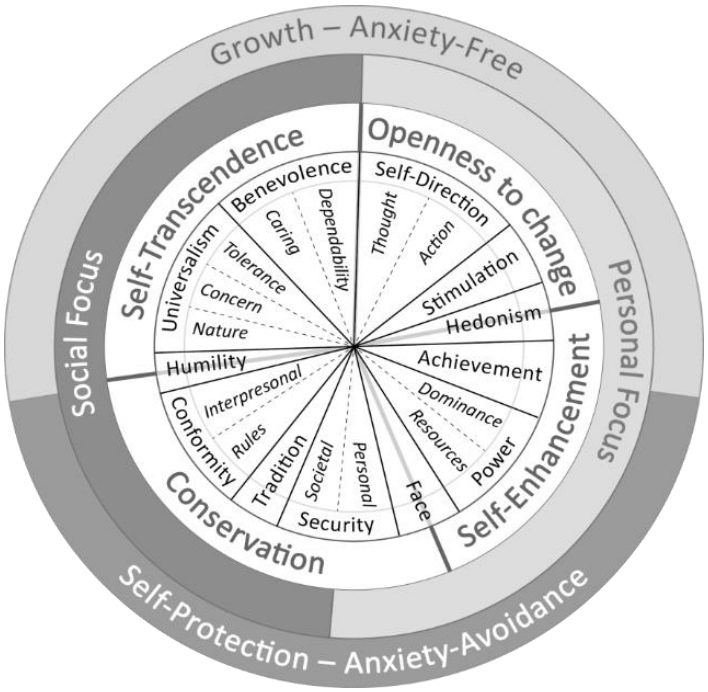

Figure 6: 19 values in the refined value theory (from Cieciuch, et al., 2014)

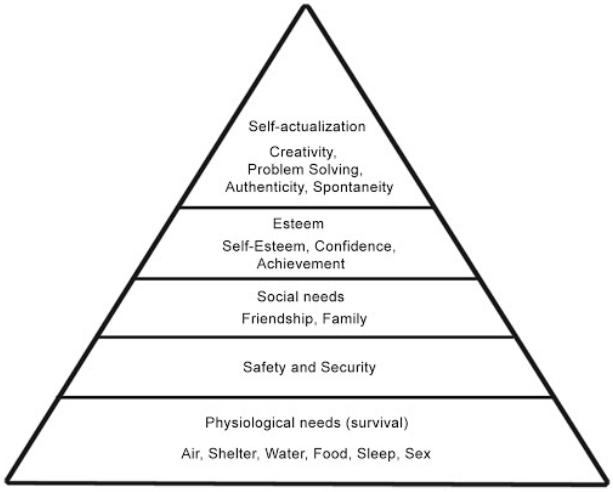

Figure 7: Maslow's Hierarchy of needs

Starting from the bottom, the foundation of the hierarchy:

- Physiological needs seem to be correlated to conservation on a personal focus. An unsatisfied need at this level may assert conservatism as highest value at that given moment.
- Safety needs seem correlated to conservation on a personal or social focus, depending on the source of the stressful stimuli. As described in the analysis, an interpersonal stressor may affect behaviour driving conformity, while a acute stressor may trigger the fight or flight response in order to conserve physiological well-being.
- Social needs seem to be congruent with conservation on a social focus – conformity; tradition. Rejection for example (usually through self-directed action or thought) may affect and diminish the value of self-direction, leading to conformity.
- Esteem needs seem to be linked to self-enhancement on a personal focus or self-transcendence on a social focus. As described in the dominance hierarchy, social dominance may lead to self-enhancing values through power over resources and dominance over people, while prestige in this level may lead to tolerant, caring, universal and benevolent behaviour.
- Self-actualization seem to be congruent with self-transcendence and openness to change on a personal and social focus. It is the self-directing though and action, with a prestige-seeking social focus on universal, objective action.

Other need theories are congruent with other values not mentioned, as for example:

- The need for stimulation – there is a separate section only for the value of stimulation.
- The need for novelty – seems to be linked to valuing openness to change and maybe hedonism.
- The need for uniqueness & the need for autonomy – is linked to the value of self-direction and seem dichotomic with the need to belong

There might not be a perfect overlay between both theories but there seem to be major linguistical similarities. While these conclusions may need deeper investigations, abductive logic make this correspondence perceptible and reasonable. Now, after

looking at the comparableness between human needs and human values, it stacks out that Hedonism is a completely separate value (opposing humility). The Rational Agent Model analyses merely the hedonistic side of human beings, even though, as one can observe above, there are a lot more incommensurable and intangible values which the human species shares. As not everything can be narrowed down to prices, different realms must be acknowledged in order to get a pragmatic understanding of the real world and its components.

Chapter 7
Results

As the basis of this research was a secondary data analysis, the results are outright exposed in the analysis section. Here is a brief result section containing the main findings of this research.

While the RAM distorts reality, behavioural economics tried to shed new light on human decision-making. Cognitive biases have been extensively explored and were evidenced in various forms (anchoring effect; endowment effect; etc). As the basis of our cognition lies within the “eco”- the human body, the research focused on the exploration of the effect of the human body on decision-making investigating various phenomenon. As human needs create pathological effects if not satisfied, how do these effects affect decision making of the individual? The recurring theme around human needs is that it pushes the body out of homeostasis, which internal processes try to diminish to regain equilibrium.

Physiological needs are the basis to sustain life and affect homeostasis in various forms. The need to eat for example, can be controlled if the unconscious decision when to eat is made conscious. But once the choice of eating is made, physiological changes alter the need to eat for the rest of the day. The need to sleep, though it varies a lot around species and humans, affect cognitive performance crucially. Addiction, through the forming of “bad habits” create a bodily and/or mental needs which alter cognition and decisions, where even the light of new information may not alter behaviour. Physiological needs seem to be highly correspondent with values with regards to conservation.

A lack of safety is responded with stress. Stress creates physiological changes, and depending on the intensity, duration, and the stressful stimuli itself, can cause fight-or-flight response and / or long-term detrimental health effects. Security needs also seem to be correspondent to conservatist values.

Belongingness is a fundamental part of human being, and can easily influence behaviour through Groupthink or Behavioural Contagion. Rejection, depending on the proximity of the rejector and cause of rejection, can alter behaviour in adaptive or maladaptive ways, or be ignored. The need to belong also seem congruent with values of conservation.

Esteem needs, with regards to the social dominance hierarchy, and depending on the position within the hierarchy, can control behaviour of others or feel a need to subordinate, consciously or unconsciously. The loss of autonomy is associated with adjusted behaviour. Values regarding this need seem correspondent to conservation or self-enhancement.
Self-actualization, in humanistic terms, is the rational ethos, where individuals don't need to satisfy their physiological and psychological needs as they have enough support to be self-confident, without feeling the need to control others. Here, actions are guided by creativity, empathy, an acceptance of facts, and problem solving, where individuals may try to reach their potential, what seem to be linked to transcendental values.

While the RAM narrows value hedonistically down to prices, human needs are linguistically very similar to universal human values, and seem to have an intimate relationship. Unsatisfied physiological needs may turn security (physiological security) as top value, disregarding self-direction, as the loss of autonomy demonstrates (loss of autonomy - to control hunger; the consumption of addictive substances). The same goes with threats to physical and / or mental security. Belongingness is also within this realm, as rejection can cause conformity, leading conformity to a higher value then self-direction. The Esteem need is linked to either self-enhancement, or self-transcends, depending on how the dominant individual treats the subordinates. Social prestige vs social dominance clearly demonstrates this difference, and that benevolence is highly valued, while power through dominance is looked down on. Ultimately, self-actualization is highly linked to self-transcendence and openness to change. The creative, problem solving individual who doesn't seek to control others with his actions, neither want to hedonistically enhance himself, breaking norms of tradition and creating change in the world, as seen by Alexander Fleming who brought change to the world without seeking financial gains through it.

Chapter 8
Discussion

> "… master-economist must possess a rare combination of gifts. He must reach a high standard in several different directions and must combine talents not often found together. He must be mathematician, historian, statesman, philosopher-in some degree. He must understand symbols and speak in words. He must contemplate the particular in terms of the general and touch the abstract and concrete in the same flight of thought. He must study the present in the light of the past for the purpose of the future. No part of man`s nature or his institutions must lie entirely outside his regard." (Keynes, J. M. 1924.)

While the RAM offers security, structure, is a great heuristic to understand some basic economic concepts through its application, and is an ecologically rational choice itself, it distorts reality and creates a self-fulfilling prophecy. Instead of neutrally observing the world as science does, it distorts reality through a heuristic theory on human nature. Multiple realities must be observed, described and explained, giving space for the observable reality to enable economists to get a clear picture of the world.

The quantifiable prerequisite made economics lose its social science basis and turned it into a purely mathematical discipline. While mathematics is the basis to calculate expected values; returns of investment; cost-benefits, and for scientific research itself, not everything can be narrowed down to prices, quantities or expected values. Humans, as social animals, as complex beings, as transformers of the world and creators of their reality and well-being, have incommensurable values, evidenced in psychology and reflected within ecological rationality.

While bounded rationality, as precursor of behavioural economics, shed new light on how perception affects decisions and judgement, and cognitive biases as Daniel Khaneman demonstrated, easily drive individuals into suboptimal or irrational choices, cognition is only one aspect of the decision-making process of human beings.

The multidimensionality of human needs and this research gives a solid basis for analysis and opportunity for future research in each segment. But more importantly, it gives a historical and evolutionary basis of various mechanisms the body adapted over time in order to secure its survival in various environments, from deserts to jungles to islands to mountains, permitting an evolutionary view of human nature.

How does ecological rationality differ? Depending on the unsatisfied need and subjective perception, the effects can have a wide array of potential outcoes which highly oscillate on a number of variables and can mostly be linked to an altered course of action, which needs a deeper investigation within each segment.
Limits are the lack of practical applications and the difficulty of quantifying various stipulations made. The resulting research observes a world of possibilities but no specific statements on what, where, how, or how much individuals gets affected by a lack of needs and their coping mechanisms, as most of them depend highly on subjective perception.
Limitations of the methodology are, if and how motivations affect values was not quantitatively proven and suggests future research, which may be difficult to accomplish due the incommensurability of these values.
While cognitive processes are predominantly researched, as the most peculiar attribute of humans is his cognition, the bodily and biological basis should not be pushed into the background in order to get a clear picture of the fundamental parts of the economy.

Chapter 9
Conclusion

> "Doubt is an uncomfortable condition. But certainty is a ridiculous one."
> Voltaire

How does ecological rationality gets affected by the body? As the primary home of cognition, the human body can easily affect cognitive processes. A simple unsatisfied need may push the body out of homeostasis and alter the ecological rationality in a wide array of possibilities that drive decisions.
The chosen methodology of this research seems appropriate given the interdisciplinary nature of it, as the secondary data analysis permits a new scope in interdisciplinary realms. Furthermore, it offers a ocean of new research questions within each segment. Does decision-making differ greatly between sleep deprived individuals and rested individuals? How much more are addicted individuals willing to pay for addictive substance then non-addicted individuals? Do individuals buy determined goods because of social contagion? If so, how effective is contagion in spreading the good? When is the cost of subordinating to high? What is the benefit of transcendent actions?

While the phenomenological experience of being limits the predictionary forces of results, this perspective of choice gave insights into the adaptive toolbox of the human body and bodily processes, driven through evolutionary pressure. Given the limited scope of behavioral economics, this research offers a fresh and alternate perspective on how ecological rationality may differ and get affected by determined human needs. Future research is needed to determine the correspondence and possible cause-effect between human needs and human values.
Overall, human needs seem like a fundamental part of the decision-making process, and offers a realm of possibilities for research within economics as well as an interesting body of information for behavioural economics.

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