"Your perspective is always limited by how much you know. Expand your knowledge and you will transform your mind."

Dr. Bruce H. Lipton

Financial Decision Making Within Thermodynamic Principles

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A good many times I have been present at gatherings of people who, by the standards of the traditional culture, are thought highly educated and who have with considerable gusto been expressing their incredulity at the illiteracy of scientists. Once or twice I have been provoked and have asked the company how many of them could describe the Second Law of Thermodynamics. The response was cold: it was also negative. Yet I was asking something which is about the scientific equivalent of: Have you read a work of Shakespeare's?

Baron William Thomson Kelvin

Abstract

The paper provides an intricately complex set of links between the fields of physics, neuroscience, artificial intelligence and climate science, and multiple loops on tourism, proposing a path to new solutions to the uncertainty that exists (already present) roots in the solution through non-isolated systems that have different connection relationships with the external environment. These relationships create complex thermodynamics and information transfer between the system and its environment. The deductive research framework seeks to see the role within a non-isolated system in shaping thermodynamic coupling as a basis for financial decision making through interdisciplinary financial knowledge, in a world where resources are limited and their use will have an impact on efficient resource management. In practice, this implies a role in the fine balance between economic growth, the risk of modern slavery, the exploitation of Earth's resources and global environmental problems such as climate change and water scarcity, which often lead to armed conflict. Negative effects can be mitigated a little by choosing the right energy sources and resources and using them as much as possible with zero or a minimum of negative side effects by applying interdisciplinary knowledge.

Introduction of Interdisciplinary Fields

Interdisciplinary knowledge is a strategic resource and the key to achieving competitive advantage. In theory, the additional knowledge gained through interdisciplinary training should be given a competitive advantage, especially as science as a whole becomes increasingly interdisciplinary (Committee on Facilitating Interdisciplinary Research, 2004; Wuchty et al., 2007). Research teams now cross not only the boundaries of social sciences (psychology-political sciences) or natural sciences (chemistry-biology), but also combine social and natural sciences (American Academy of Arts and Sciences, 2013; Interdisciplinary Research Facilitation Committee, 2004). It generates a search for a new framework of understanding in tourism uncertainty in the fields of emotion research, artificial intelligence, and climate change through

understanding the thermodynamic framework as the purpose of this paper, and the logic of thermodynamics, the science of energy transformation.

Science has also given humanity some disappointments. It has set limits on our technology, the inability to reach the speed of light; we have failed to overcome our vulnerability to pandemics, and other diseases; confronted us with inconvenient truths, with global climate change (problems can never be solved with the same mindset that created them. A. Einstein) But of all the downfalls, the second law of thermodynamics could be the greatest. We live in a universe that is becoming more and more disordered and there is nothing we can do about it. The very act of living contributes to the relentless degeneration of the world. No matter how advanced our machines become, they can never completely avoid energy waste and wear. The second law not only shatters the dream of a machine with eternal motion, but suggests that the cosmos will eventually deplete its available energy and nod its head into the eternal path known as thermal death.

Thermodynamics, the science of the relationship between heat, work, temperature and energy. In a broader sense, thermodynamics deals with the transfer of energy from one place to another and from one form to another. The key concept is that heat is a form of energy that corresponds to a certain amount of mechanical work (Britannica).

How did the first law of thermodynamics develop? Heat was not formally recognized as a form of energy until 1798, when Count Rumford (Sir Benjamin Thompson), a British military engineer, observed that unlimited amounts of heat could be generated by drilling cannon tubes and that the amount of heat produced was proportional to blunt turning. drilling tools. Rumford's observation of the proportionality between the heat produced and the work performed underlies thermodynamics. Another pioneer is the French military engineer S. Carnot. In 1824, he introduced the concept of the heat engine cycle and the principle of reversibility. Carnot's work concerned the limitation of the maximum amount of work that can be achieved from a steam engine that performs high-temperature heat transfer as its driving force. Later that century, R. Clausius, a German mathematician and physicist, developed these ideas into the first and second laws of thermodynamics, respectively.

The subject of thermodynamics was born in 1883 when J. Willard Gibbs published his work, On the Equilibrium of Heterogeneous Substances". In his work, Gibbs presented the science of thermodynamics and provided the formalism used to describe all phenomena that affect the state of matter. In its simplest form, thermodynamics focuses on how matter affects in a way beyond kinetic and potential energy, namely mechanical work is the result of material expansion and contraction, as well as the heating and / or cooling effects of material.

Zero law of thermodynamics. When two systems are each in thermal equilibrium with the third system, the first two systems are in thermal equilibrium with each other. This feature makes sense to use thermometers as a "third system" and to define a temperature scale.

Let us explain the laws of thermodynamics.

The first law of thermodynamics, or the law of conservation of energy. The change in the internal energy of a system is equal to the difference between the heat added to the system from its environment and the work that the system performs on its environment.

The second law of thermodynamics. Heat does not flow spontaneously from a colder area to a warmer area, or, equivalently, heat at a given temperature cannot be fully converted to work. Consequently, the entropy of a closed system, or thermal energy per unit temperature, increases over time toward some maximum value. Thus, all closed systems strive for an equilibrium state in which entropy is at a maximum and there is no energy to perform useful work.

The third law of thermodynamics. The entropy of a perfect crystal of an element in its most stable form weighs zero as the temperature approaches absolute zero. This makes it possible to determine the absolute scale for entropy which, from a statistical point of view, determines the degree of randomness or disorder in the system.

Although thermodynamics developed rapidly during the 19th century in response to the need to optimize the performance of steam engines, the generality of the laws of thermodynamics makes them applicable to all physical and biological systems. In particular, the laws of thermodynamics give a complete description of all changes in the energy state of any system and its ability to perform useful work in its environment.

"Thermodynamics is a strange theory". Although fundamental to our understanding of the world, it differs from other physical theories. That is why it is called the "village witch" in physics. Some of the many peculiarities of thermodynamics are the bizarre philosophical implications of classical statistical mechanics. Long before the theory of relativity and quantum mechanics brought the paradoxes of modern physics to the public eye, Ludwig Boltzmann, James Clerk Maxwell, and other pioneers of statistical mechanics struggled with several thought experiments, or demons, that threatened to undermine thermodynamics.

According to thermodynamics, every living organism is constantly exchanging the flow of matter and energy with its environment. As such, the system is out of balance. In his book What is Life? (1944), Austrian physicist and Nobel laureate Erwin Schrödinger suggested that life support is precisely based on avoiding balance: "How does a living organism avoid decay? Eating, drinking, breathing and assimilation. The technical term is metabolism. 'According to this view, the final balance is death, and therefore survival depends on staying as far away from balance as possible. In general, Schrödinger's question of what makes us survive could be just as well posed in terms of how the brain allows for an optimal degree of mixing between internal and extrinsic information. As it turns out, turbulence is nature's optimal method for mixing and transmitting energy / information through time and space in the most efficient way. New research results show that the brain uses turbulence in its quest to stay out of balance in order to survive.

Turbulence and thermodynamic imbalance are two sides of the same coin of the way the brain drives and manages the environment. These principles allow us not only to survive but also, from time to time, to progress.

"Energy flow between brain and environment drives the non-equilibrium that sustains life. Could turbulence help us thrive? "

We might lessen the risk of the brain becoming closer to equilibrium and therefore less able to engage in the world.

In psychological thermodynamics, emotional thermodynamics is the thermodynamic study of emotions, especially in terms of observing emotions as a type of energy that acts in the mind toward conserving energy or conserving force.

The concept of emotional thermodynamics, according to emotion theorist J. Hillman, originated in the theories of American psychologist H. Dunbar in 1943, based on the fundamental theories of energy psychology by Austrian psychologist Sigmund Freud. He considers emotion energy analogous to the way heat is created. chemical and electrical. Her oft-quoted expression of this logic is as follows: "The basic law of Freud's work, which is now a basic law of general psychiatry as well, may thus be called the 'first law of emotional thermodynamics' or conservation of vital energy. " (Dunbar, Helen Flanders. (1943).

"In this world nothing can be said to be certain, except death and taxes." (B. Franklin)

However, there is something safer than death or taxes: entropy. "As defined in the Second Law of Thermodynamics, entropy is the tendency of all closed systems to move toward a state of disorder rather than order. From the gradual cooling of the universe after the Big Bang to the growing clutter in our room after we neglected it for a week, all systems involving matter and energy are subject to entropy, and as such a system the human brain is no exception. But while the entropy represented by a crowded room is less than a desirable state of affairs, according to a researcher from Imperial College London, a small disorder in the human brain isn't necessarily a bad thing".

We consider it normal that the laws of classical physics apply to biology, especially to the neural system. The evoked cycle represents the exchange of energy / information of the brain with the physical environment through stimuli. Thus, the thermodynamics of emotions could elucidate the neurological origins of intellectual evolution and explain the psychological and health consequences of positive and negative emotional states based on their energy profiles. Positive emotional states can be represented by the inverse S.Carnot cycle, while negative emotional reactions trigger the S.Carnot cycle. These two states have opposite energy and entropic consequences with consequences on mental energy. The mathematics of Carnot's and Carnot's inverse cycles can explain recent discoveries in psychology, and could be constructive in the scientific effort to turn psychology into a solid science.

The metabolic activity of the brain is extremely constant over time. This constant metabolic activity mainly consists of the oxidation of glucose to carbon dioxide and water resulting in the production of large amounts of energy in the form of ATP. This high metabolic activity is present when we are completely passive and

resting as well as when we are doing something noticeable. Two lines of research have recently merged in their analysis of how this energy is used. Both focused on the metabolic requirements associated with glutamate signaling in the brain. This focus would seem reasonable, given that more than 80% of neurons are excitatory and more than 90% of synapses release glutamate (Abeles M., 1991; Braitenberg V. & Schuz, A., 1998). Attwell and Laughlin (Attwell D. & Laughlin, S. B., 2001, J. Cereb) took a bottom-up modeling approach using existing data on the retina of blowers and the cerebral cortex of mammals. Estimates from their approach show that most of the energy used in the brain is needed to expand action potentials and to restore postsynaptic ion flows after receptors have been stimulated by a neurotransmitter. In contrast, maintaining resting potential in neurons and glial cells accounts for less than 15% of total energy expenditure. Shulman and colleagues (Sibson N. R., Dhankhar, A., Mason, G. F., Rothman, D. L., Behar, K. L. & Shulman, R. G., 1998; Shien N. R., Petersen, K. F., Behar, K. L., Nixon, T. W., Mason, G. F., Petroff, O. A. C., Shulman, G. I., Shulman, R. G. & Rothman, D. L., 1999) in a very different approach using MRS in anesthetized rats showed remarkably converging evidence that a very large proportion (≈80%) of energy expenditure in the brain is associated with glutamate circulation and, therefore, active signaling processes.

The energy expenditure of the brain is dependent on frequency by maintaining its self-organization of activities and encouraging the modification of synaptic maps and corresponding mental changes (Dabaghian, 2019). Excitation produces an intricate and complex game of sharply changing, evoked potential (Sur & Sinha, 2009). In the brain as a computer object (Fry, 2017; Deli et al., 2018; Street, 2016; Maass et al., 2019), the induced activities reflect increased "temperature". Earlier consideration of brain temperature is a measure of imbalance and heterogeneity on different spatial and temporal scales (Papo, 2013). However, emotional moderation refers to the degree of ability to convey information. The ability to transmit information increases with frequency (higher frequencies transmit more information than lower oscillations per unit time). The sensory system is a spontaneous transmitter of information, controlled by a stimulus. The potentials of electrical currents between the cortex and the limbic brain formulate automatic and involuntary energy-information exchange with the environment. The resulting brain frequencies depend on the entropy of the environment. Order, beauty evokes calm, happy states, which reflect lower frequencies than stressful states resulting from environmental disturbances. Therefore, the brain "pays from absorbed environmental information to elevated brain oscillations. Sensory perception can be considered a thermodynamic cycle (Deli et al., 2018; Fry, 2017). A recurring state of rest ensures particle-like stability of the mind (Deli, 2020a, b). Electromagnetic gradients form fluid, wavy activation patterns on cortical surfaces, in a positive correlation between spatially distributed cortical areas (reviewed by Muller et al., 2018). Harmonic brain modes, defined as harmonic connectors, show the self-organization of frequency-specific building blocks". (Fingelkurts & Fingelkurts 2014; Atasoy et., 2016).

Animal brains are biological structures, made up of matter and energy just like everything else in the universe. They do not create or destroy energy, they only convert it from one form to another. Neurons store chemical energy in the form of ATP and various neurotransmitters, which is converted into electrical impulses (which send signals to the body) and eventually into waste heat. "Feelings" are no different than any other chemical process.

Artificial intelligence (AI), the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. The term is frequently applied to the project of developing systems endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from past experience. Since the development of the digital computer in the 1940s, it has been demonstrated that computers can be programmed to carry out very complex tasks - as, for example, discovering proofs for mathematical theorems or playing chess - with great proficiency. Still, despite continuing advances in computer processing speed and memory capacity, there are as yet no programs that can match human flexibility over wider domains or in tasks requiring much everyday knowledge. On the other hand, some programs have attained the performance levels of human experts and professionals in performing certain specific tasks, so that artificial intelligence in this limited sense is found in applications as diverse as medical diagnosis, computer search engines, and voice or handwriting recognition.

Artificial intelligence is a key component of digital twins (real-time digital models). The digital twin can help predict the exact amount of carbon emissions a ship emits when docking in port. This data collected thanks to artificial intelligence can then be used to develop solutions that consume less fuel and to study its impact on the environment.

Sustainable design, a design that reduces negative environmental impact and supports the concept of the circular economy, also benefits from AI and the use of Digital Twin. With this augmented reality, a building, ship, port, or city can be designed using artificial intelligence to understand the environmental impacts of building design before it is even built.

AI can process large amounts of complex data, it can help make predictions ranging from energy optimization to what will happen to our planet and oceans in the future if we don't reduce climate change. Thanks to predictability, tests can be done to see if the solutions will work, and then, if something is proven to be harmful to the environment, it can be prevented. For example, it can be predicted that a vessel's route will use the least amount of fuel possible, thus helping the climate by reducing environmental impact along the route.

Complex systems are ubiquitous in nature, and physicists have achieved great success using thermodynamics to study these systems. Machine learning can be very complex, can thermodynamics be a way of understanding?

The effects of climate change are becoming increasingly visible. Storms, droughts, fires and floods are becoming stronger and more frequent (Field Christopher B., Barros Vicente, Stocker Thomas F., and Dahe Qin. 2012). Global ecosystems are changing, including the natural resources and agriculture on which humanity depends. Machine learning (ML) is recognized as a widely powerful tool for technological progress. So ML, like any technology, doesn't always make the world a better place - but it could. In the fight against climate change, ML has a significant contribution in all areas. ML can enable automatic monitoring through remote detection (by specifying deforestation, collecting data on buildings and assessing disaster damage). It can speed up the process of scientific discovery (by proposing new materials for batteries, construction and carbon capture). ML can optimize systems to improve efficiency (by consolidating cargo, designing a carbon market, and reducing food waste). And it can speed up computationally expensive physical simulations through hybrid modeling (climate models and energy distribution models).

We could conclude? The concept of artificial intelligence, or AI, is often discussed, but can be slightly more difficult to define. Essentially, it refers to computers or machines performing tasks that would normally require human intelligence to carry out. This could, for example, be learning lessons, making decisions, or recognising and interpreting speech.

In the modern age, it is an accepted fact that businesses will collect and store vast quantities of data. This can help to enable AI, with machines using the data to perform tasks ranging from data analysis and problem-solving, through to speech translation, direct messaging and improving personalisation during the customer journey.

A review of financial decision making through thermodynamics

Thermodynamics, the great theory of nature, provides a pictorial perspective on motives and movements: forces are causes, and changes in motion are consequences. While fundamental properties, especially energy and time, are not explicitly and accurately related to solid physical entities, theorizing with cognition (Wolpert, 2004; Friston, 2010; Ortega and Braun, 2013; Annila, 2016; Roy, 2016; Deli et. Al., 2018, 2021) is modeling in terms of game theory (Jaynes et al., 1985; Anttila and Annila, 2011; Babajanyan et al., 2020) or modern physics (Busemeyer and Bruza, 2012; Roy, 2015; Rastmanesh and Pitkänen , 2021). Thus, a concrete axiom is needed to conceptualize natural processes, such as decision making.

In his quest for a universal theory, Ludwig Boltzmann sought to derive thermodynamics from the atomistic axiom, but failed (Boltzmann, 1905). As Boltzmann's contemporaries have already noted (Loschmidt, 1876; Zermelo, 1896), the well-known theory of many bodies applies only to the steady state, where motions are repetitive rather than irreversible. So the expression of thermodynamics in evolutionary terms had to wait for new times (Annila and Salthe, 2010).

The problem was not that Boltzmann explicitly knew the elementary composition, because his atomistic theory was without scale. The problem was that he wrongly approximated the motion of atoms as random, not forced. Boltzmann adopted a random walk, hence the Gaussian approximation, which led to the Boltzmann distribution, from Adolphe Quetelet, a pioneer of social physics (Ball, 2014). Modeling society in statistical terms has led to modeling a molecular ensemble, rather than both making sense in a thermodynamic sense.

Stochastic approximation reproduces data in thermodynamic equilibrium, where forces disappear and nothing happens. However, natural processes, including information processing, occur, that is, quantum flows (Annila, 2021). Imbalance is the cause; changes in movement are consequences. Data are arranged around the mean in a distorted way rather than symmetrically (Contreras-Reyes, 2021). Distributions accumulate along sigmoid curves that follow mostly straight lines, i.e., the laws of forces on log-log diagrams (Limpert et al., 2001; Newman, 2005; Bennet and Bennet, 2008; West, 2017). So empirical evidence against random processes is irrefutable. School textbooks on thermodynamics (Callen, 1991) are not the right starting point for making sense, while unbalanced thermodynamics seems perfect (Mäkelä and Annila, 2010).

In addition to facts and figures, decision-making neither shows nor implies anything special. From molecules to humans and cells to society, data related to decision-making, when drawn without legends and labels, is similar to any other process (Wohrer et al., 2013; Altman, 2015). The ubiquity of patterns speaks to the universal law of nature that gives meaning to decision-making.

Thermodynamic theory quantitatively evaluates decisions according to their shortest free energy consumption. The holistic criterion holds that the more force is taken into account, the better the decision. At the neural level, this is manifested in evolution toward larger neural networks. At the societal level, this means advancing from uniformity to cohesive diversity. Failure to put yourself in someone else's position or group thinking leads to the risk of making bad decisions. Going against the greatest forces, which present themselves as values, morals and trust, is especially disastrous because they hold the system together. Disrupting global unity by complaining about natural forces results in catastrophic consequences (climate change and loss of biodiversity).

The decision to evaluate comes with the benefits of backward insight. The course of events reveals neglected forces. As all processes follow the same principle, history offers us lessons. Well, non-prediction of consequences arises from non-seeing the cause, namely, the force of connecting the present case with past events and not drawing parallels in the whole hierarchy of existence.

Although thermodynamic theory will not meet all the expectations often associated with theory, decision prediction. Yet the theory clarifies that natural processes are intrinsically unsolvable because everything depends on everything else. As the variables cannot be separated to solve the equation of motion, the future lies beyond precise predictions. On the other hand, the theory clarifies that the future opens up from spending resources through structures inherited from the past. From this perspective, the whole cognitive ability, decision-making at its core, is focused on projecting oneself from the past into the future. Consciousness adheres to the present (Fingelkurts and Fingelkurts, 2014), where quantum flows move one way or another (Tuisku et al., 2009; Annila, 2021).

Decision-making implies the existence of free will (O'connor and Franklin, 2021). The concept seems unattainable. According to thermodynamic theory, free will corresponds to free energy (Annila, 2016). Decisions are as relevant as they can be. Those in power decide how free energy will be spent, that is, what will happen. Only decision-making consumes resources (by acquiring and processing information.). Therefore, decisions are always limited by free energy, say, free will. Determinism is at odds with thermodynamics that is consistent with common sense by verbalizing it in accurate and comprehensive terms. Thermodynamic theory clarifies that decision-making, as a natural process, takes place through mechanisms. In short, molecular, neural, organisms, social, environmental structures influence decision making. Today, it is difficult to think outside the box because it implies the emergence of new structures and the abandonment of old ones. So this way of spending free energy is called creativity, sometimes dissent.

Emotions, Uncertainty, Information

Electroencephalogram (EEG) based intelligent brain-computer (BCI) systems can encourage continuous monitoring of fluctuations in the human brain under emotional stimulation, which is of great importance for the development of brain emotional mechanisms and artificial intelligence for medicine. diagnosis (Gu et al., 2021).

Emotion research indicates that local neural complexity is sensitive to affective valence assessment, while regional levels of neuro-cortical connectivity are mostly sensitive to affective arousal assessments (Aydın, 2019). There is a mechanism for processing attention bias for emotions. Some research has shown that angry faces can automatically trigger attention, that is, there is an effect of anger dominance. Some studies have

shown the existence of a happiness dominance effect (Xu et al., 2019). Most psychologists consider subjective experiences to be a central component of emotions, emphasizing the role of consciousness in emotional production and emotional state. However, discussing emotional issues from the perspective of unconscious emotions has a deep tradition in psychological research. Unconscious emotion known subliminal emotion, refers to the change of thoughts and emotions caused by certain emotional states (Li and Lv, 2014). This emotional state is independent of his conscious consciousness, and the induction of that emotional state is unconscious (Jiang and Zhou, 2004; Wataru et al., 2014; Zheng et al., 2021a). Subliminal representation of stimuli is an important research topic in the field of unconscious perception.

Uncertainty is a characteristic of the world and a concept in theories of cognition and emotion. In cognitive information value theories, mathematical entropy quantifies uncertainty about a variable with respect to probability distribution. Uncertainty can be reduced by collecting information, quantified as information gain (Lindley et al., 1956; Oaksford & Chater, 1994; Crupi, Nelson, Meder, Cevolani, & Tentori, 2018). Many different entropy models for quantified probalistic uncertainties have been proposed. Although Shannon entropy is widely used (Coenen, Nelson, & Gureckis, 2018; Fuhrman et al., 2000; Martignon, Von Hassein, Grun, Aertsen, & Palm, 1995; Oaksford & Chater, 1044), other entropy measures are also important in some context. Square entropy (Lande, 1966) is important in ecology; the families of Reny entropies (R´enyi et al., 1961) proved powerful in computer science and image processing; Tsallis entropies (Tsallis, 2011) are widely used in physics.

Research on cognition and emotions about the perception of human uncertainty has so far remained separate from each other, despite their common theoretical basis. Cognitive theories of emotion define uncertainty as a cognitive component that characterizes emotional states (Smith & Ellsworth, 1985; Scherer, Schorr, & Johnstone, 2001). Thus, anger and pride are characterized by low assessments of insecurity, while anxiety and curiosity are characterized by high assessments of insecurity. Previous research has investigated the role of emotions in judgment, risk assessment, and decision making under uncertainty. Emotion-related uncertainty estimates have been found to modulate risk assessment and information processing (Tiedens & Linton, 2001; Lerner & Keltner, 2001). In these studies, psychological insecurity is assessed using questionnaires that ask the respondent about their subjective assessment of uncertainty in situations (Smith & Ellsworth, 1985). The conceptualization of psychological uncertainty lacks precise quantification and mathematical formalization. Entropy thus offers a mathematically accurate quantification of uncertainty, uncertainty estimates, and entropy perceptions are related, and the entropy question in emotions is open. We have a lack of research (Hirsh, Mar and Peterson, 2012, exception) in the roles of different characteristics of emotions in fundamental assessments of probalistic uncertainty and in behavior directed toward insecurity.

Cognitive emotion theories state that emotions are characterized by cognitive assessments (Smith & Ellsworth, 1985; Scherer et al., 2001). The Assessment Propensity Framework (Lerner & Keltner, 2000) argues that emotional states of high uncertainty are associated with increased risk perception, leading to systematic information processing and reduced risk-seeking behavior (Tiedens & Linton, 2001; Lerner & Keltner, 2001). Wright & Bower, 1992; Smith & Ellsworth, 1985). Other theories of emotion give different predictions: the theory of feelings as information (Schwartz, Woloshin, Black & Welch, 1997) conceptualizes emotions as a source of information about the situation and predicts that negative affective states will motivate hard, systematic and analytical thinking, while positive affective states lead to heuristic information processing effortlessly. It is assumed that the valence of emotion influences probability and risk assessment (Wright & Bower, 1992), with negative moods making assessments more negative and positive moods influencing assessments in a positive direction. The relationship of emotional cognition can be interpreted in terms of cognitive load. In this regard, emotions distract resources from cognitive tasks and thus interfere with cognitive processing (Plass & Kalyuga, 2019). Emotions may have the function of directing attention distribution (Derryberry & Tucker, 1994; Wichary, Mata, & Rieskamp, 2016).

Understanding the second law of thermodynamics and climate challenges

A human being is part of the whole, called by us 'Universe'; a part limited in time and space. He experiences himself, his thoughts and feelings as something separated from the rest – a kind of optical delusion of his consciousness. This delusion is a kind of prison for us, restricting us to our personal desires and affection for a few persons nearest us. Our task must be to free ourselves from this prison by widening our circle of compassion to embrace all living creatures and the whole nature in its beauty. Nobody is able to achieve this completely but striving for such achievement is, in itself, a part oft he liberation and andation for inner security.

(Einstein, 1950, p. 12)

The human body (like other living organisms) is a complex, multilevel symbiosis of parts. The most basic ingredient of any organism is the atom, because atoms make up chemical molecules. In biology, molecules can be astounding and of enormous complexity. Molecules come together to form cells, which make up tissue, such as skin, bone or muscle tissue. Tissues consist of organs, such as the heart or liver, that are grouped into systems, such as the nervous or digestive systems. Systems make up the body. All these different levels of organization add up to a very complicated and highly organized system.

Globally, energy transformations are cyclical. Sunlight affects plants while providing energy to trigger photosynthesis that produces carbohydrates from CO_2 and water. Some of them we eat directly, and some indirectly, while we eat animals that ate plants (or other animals that ate ...). Our digestive system and cells convert what we eat and breathe into usable energy. Our waste products include CO_2 and water, which the plants then reuse. The details go beyond this overly simple illustration, but the idea is the same - the cycle of matter through plants, then animals, then back to plants. But the initial solar energy is eventually radiated back into space as heat and lost. New solar energy must be constantly pumped in order to keep the cycle going, according to the Second Law of Thermodynamics.

The calculation shows that the Earth obeys the Second Law of Thermodynamics (Carroll (2010), 192-3.) Solar energy is at a high temperature and therefore has a relatively low entropy, while the energy radiated from the Earth back into space is at a lower temperature. higher entropy, which guarantees that the entropy of the whole system increases. (Mathematically, entropy is the heat emitted divided by temperature.)

It is necessary to understand the revised second law of thermodynamics. General version of the second law in terms of concentration and dispersion of energy: any spontaneous process must move the isolated system towards a state of more uniform state of dispersion of energy throughout the system. By isolated system we mean one for which energy does not come out or enter. Thus, we know that a higher temperature means a higher average heat energy per molecule, so we can think of temperature as a measure of the concentration of heat energy in an object. If we consider a warm object in a cold room as our complete system, then the thermal energy in our system is not well dissipated because it is more concentrated in a hot object. The second law of thermodynamics predicts that energy should move from a hot object to a cold environment in order for energy to dissipate better, and this is what we observe. However, heat transfer will occur only until the thermal energy is maximally dissipated, which corresponds to thermal equilibrium, and is marked by the same temperature of the building and the environment.

"When one meets the concept of entropy in communication theory, he has a right to be rather excited- a right to suspect that one has a hold of something that may turn out to be basic and important… One must think a long time, and consider many applications, before he fully realises how powerful and general this amazingly compact theorem really is". (Shannon & Weaver, 1949, p. 13)

The second law directs our bodies towards higher entropy (entropy (S) is a measure of energy dispersion within the system. Increasing entropy corresponds to increasing energy dispersion. occur spontaneously if it increases the total entropy of the isolated system), which means thermal balance with the environment. Unless the ambient temperature is close to body temperature, achieving thermal balance means death. Life also requires a concentration of chemical potential energy, but because of the Second Law we strive for a chemical balance that cannot be survived. Concentrations of electricity drive our nervous system, but due to the Second Law we are constantly in danger of achieving internal electrical balance without electrical activity. Life is a constant struggle against various types of balance that would correspond to maximum entropy, but also death. The work necessary to fight the increase in our own entropy is what we consider to be the basic metabolism. Doing that job, and even taking the energy needed to do that job, involves real processes that provide even more opportunities to increase entropy in a seemingly viscous cycle. You can't beat the Second Law of Thermodynamics! Even when we manage to prevent an increase in our own entropy, we cause an increase in the entropy of the environment by a greater amount than what we have prevented within ourselves. In fact, the complete dispersion of energy, so that all matter is in equilibrium, and there are no processes left that would increase entropy, and nothing really happens, is one possible fate of the universe called thermal death. At least we do not expect the thermal death of the universe to occur at least ten per thousand years-10100) (OpenStax, College Physics. OpenStax CNX. Mar 6, 2019.)

Thermodynamics, the science of energy interactions, governs the direction of processes found in nature. Although the subject is widely used in science and technology, its connection with the biological sciences, and especially with bioengineering, is becoming increasingly important.

The human body is viewed as an open thermodynamic system. Its stability to the influence of adverse environmental factors is determined by the potential of its energy. The index of this energy is the maximum aerobic power (maximum oxygen consumption). This index in ml / min / body weight can be considered as a quantitative description of somatic health.

Nothing in the world happens without energy costs. It also touches on life as a process (Bauer E., 1935; E. Schrodinger, 1944). The greater the energy potential of a biosystem, the more resistant it is to external and internal influences (Apanasenko G.L., 2015; Bauer E., 1935). Energy formation in a living system is the process of transforming solar energy into other types of energy. A possible link between the creation of energy in a living system and its accumulator are mitochondria. The sustainability of a biosystem is characterized by its energy potential that can be identified with the measured level of somatic health (Apanasenko G, L., Popova L.A., 1998). This means that health can be managed (controlled, saved, restored, strengthened) sustainability.

Under the influence of negative environmental factors, unhealthy lifestyle, aging there is a decline in energy efficiency within the cellular form. In accordance with the thermodynamic concept of health and prophylaxis (Apanasenko GL, 1990), the release of energy efficiency within the cellular form outside SHL is accompanied by the phenomenon of "self-development" of the pathological process and is the primary cause of ND epidemic. - pathology). With the distribution of similar changes in the population scale, in addition to the development of the ND epidemic, the aging rate accelerates, reproductive function suffers, physical and psychophysical internal and other decline, ie the phenomenon of biological degradation (Apanasenko GL, 2014).

Understanding In Knowledge of Climate Change

To see a world in a grain of sand,

And a heaven in a wild flower,

Hold infinity in the palm of your hand,

And eternity in an hour. (Blake, 1803)

The Earth's climate is not stable: it has undergone tremendous changes in Earth's history, from an episode of icy snowstorm (Hoffman et al., 1998) to extreme late Cretacean heat that allowed crocodile reptiles to roam the Arctic (Tarduno et al., 1998).). Such climate variability occurs at a number of time intervals (Ghil and Lucarini, 2020) and implies imbalances in planetary energy and entropic calculations. In the context of the observed climate change of recent decades and projected over the next century, these energy imbalances are small relative to total inflows and outflows (Trenberth, Fasullo, & Balmaseda, 2014). climate.

We think of climate change as slow, but it is unnervingly fast. We think of the technological change necessary to avert it as fast-arriving, but unfortunately it is deceptively slow, especially judged by just how soon we need it. David Wallace-Wells, 2019

Life itself is an irreversible process, however, despite their ubiquity, irreversible processes are handled in a simplified way in large-scale studies involving atmospheric circulation (Emanuel, 2001), while numerical climate system models treat irreversible processes in a physically inconsistent way (Becker and Burkhardt, 2007). .), completely ignore certain irreversible processes (Pauluis and Held, 2002a; Pascale et al., 2011), or numerical sources of entropy? (Woollings and Thuburn, 2006). Interaction between communities of climate scientists and physicists developing tools as understanding of irreversible processes remains limited. Encouraging collaboration between these communities has the potential to reveal methods for analyzing and understanding the climate system, especially in the context of a rapidly changing climate (Lucarini, Fraedrich, & Lunkeit, 2010a).

A climate system can be defined in several ways, each of which differs in the extent of radiation that is treated as part of the system rather than as part of the environment (Bannon, 2015; Gibbins and Haigh, 2020). Focusing exclusively on matter within the climate system, which can be considered a second law provides a direct limit on the speed at which the heat engine of the climate system performs work (Pauluis

and Held, 2002a; Goody, 2003). The perspective of atmospheric circulation heat engines has been shown to allow theoretical limitations on convective ascending flow rates (Emanuel and Bister, 1996), tropical cyclone intensity (Emanuel, 1986), and atmospheric meridional heat transfer (Barry, Craig, & Thuburn, 2002). While the theory of the potential intensity of tropical cyclones has been quite successful (Emanuel, 2018), the development of the theory of first principles for convective ascending velocity based on the second law challenges the dominance of wet irreversible processes in the calculation of atmospheric entropy (Pauluis and Held, 2002a; Singh et al. Gorman, 2016). Continuous work confirms the important role of humid processes such as water vapor mixing and cloud microphysics in limiting rising cloud currents (Parodi and Emanuel, 2009; Singh and O'Gorman, 2013, 2015; Seeley and Romps, 2015). The success of meridian theories heat transfer to the atmosphere is limited by the extent to which the effects of humid processes on atmospheric circulation are counted. Such wet processes are influential in managing the atmospheric circulation response to global climate change (Lalibert´e et al., 2015; Singh and O'Gorman, 2016). Examining the entropy calculations and heat engine characteristics of climate models and other planets may provide a path to a better understanding of the Earth's climate system (Lucarini, Fraedrich, & Lunkeit, 2010a; Lembo, Lunkeit, & Lucarini, 2019). The heat engines of other planets differ from the planets on Earth leading to an implicit assumption about the thermodynamics of planetary circulations (Koll and Komacek, 2018).

The scope of research on classical thermodynamics and statistical mechanics that can be applied to climate issues is wide and in many cases well developed. Statistical mechanics approaches already existed and are applied to climate models in the form of applications of Hamilton fluid mechanics to ocean vortex parameterization (David, Zanna, & Marshall, 2018) and the use of statistical mechanics principles for stochastic parameterization, as recently reviewed by Ghil and Lucarini (2020).). This means increased collaboration between climate scientists and physicists.

"The second law of thermodynamics says that heat cannot flow from a cold body to a hot body without some form of work. Therefore, deniers claim that the heat trapped in the air and greenhouse gases can never heat the earth because the Earth's surface is warmer than gases. If heat flowed from colder air to a warmer surface it would be contrary to another law. However, these deniers are inaccurate because greenhouse gases do not directly heat the Earth's surface, they only prevent heat loss from the surface. As the Earth releases heat to go into space, greenhouse gases act like cell walls and block the amount of heat that passes through them. The earth's surface does not heat up because as heat flows from the gases, it heats up because the rate of heat release from the surface slows down. Deniers view greenhouse gases as a heating pad that directly warms the body when greenhouse gases are much more like a blanket that just prevents heat from leaving the body. The earth is warmed by its own heat, not the heat of greenhouse gases, which is in line with the second law of thermodynamics". (Brief Responses to Climate Change Denialism Statements, CPSG 200Science & Global Change Sophomore Colloquium, 2018).

Tourism in the Face of Uncertainty and Uncertainty

"We really are running out of time".

"When you sort of put the environment in a geopolitical perspective, we see what a perfect storm we're facing right now". (Blumstein)

Scientists know that recent climate change is largely caused by human activities from understanding basic physics, comparing observations with models, and taking fingerprints of detailed patterns of climate change caused by various human and natural influences.

Different climate impacts have different signatures in climate records. These unique fingerprints are easier to see by probing beyond a single number (such as the average temperature of the Earth's surface) and by observing geographic and seasonal patterns of climate change. Observed patterns of surface warming, changes in atmospheric temperature, increased ocean heat content, increased atmospheric humidity, rising sea levels, and increased land and sea ice melting also correspond to patterns scientists expect to see due to human activities (see Question 5).

Since the mid-1800s, scientists have known that CO2 is one of the major greenhouse gases important for the Earth's energy balance. Direct measurements of CO2 in the atmosphere and air trapped in ice show that atmospheric CO2 increased by more than 40% from 1800 to 2019. Measurements of various forms of carbon (isotopes) reveal that this increase is due to human activities. Other greenhouse gases (especially methane

and nitrous oxide) are increasing as a result of human activities. The observed increase in global surface temperature since 1900 is consistent with detailed calculations of the impact of the observed increase in atmospheric greenhouse gases (and other changes caused by human activity) on the Earth's energy balance.

Expected climate change is based on our understanding of how greenhouse gases retain heat. And this fundamental understanding of greenhouse gas physics and sample-based fingerprint studies show that natural causes alone are not enough to explain recent climate change. Natural causes include variations in sunrise and Earth's orbit around the Sun, volcanic eruptions, and internal fluctuations in the climate system (such as El Niño and La Niña). Calculations using climate models have been used to simulate what would happen to global temperatures if only natural factors affected the climate system. These simulations lead to little surface warming, or even slight cooling, during the 20th century and up to the 21st century. Only when the models include human influences on the composition of the atmosphere, the resulting temperature changes are consistent with the observed changes.

"It's easy to take our planet for granted until we see the human cost of its degradation: hunger, displacement, unemployment, illness and deaths". (Agnes Callamard, Amnesty International's Secretary General)

Scientists have made great strides in observing, theory, and modeling the Earth's climate system, and that advances have allowed them to project future climate change with increasing confidence. However, several major problems make it impossible to make accurate estimates of how global or regional temperature trends will develop decade by decade into the future. First, we cannot predict how much CO_2 human activities will emit, as this depends on factors such as how the global economy is evolving and how society's energy production and consumption are changing in the coming decades. Second, with the current understanding of the complexities of climate feedback, there are a number of possible outcomes, even for a particular CO_2 emission scenario. Finally, over a period of ten years, natural variability can modulate the effects of the underlying temperature trend. In summary, all projections of the model show that the Earth will continue to heat up significantly more over the next few decades to a century. If there are no technological or political changes to reduce emission trends from their current trajectory, then further global average warming of 2.6 to 4.8 ° C (4.7 to 8.6 ° F) could be expected in addition to that already happened during the 21st century Projecting what these ranges will mean for the climate at any given location is a challenging scientific problem, but estimates continue to improve as regional and local models progress.

The Role of Emotions in Tourism

Emotions are at the core of tourism experiences (Aho 2001; Bastiaansen et al. 2019; Knobloch, Robertson, & Aitken 2017; Tussyadiah 2014). Previous research has identified the relevance of emotions in different settings such as festivals (e.g. Lee 2014), shopping (Yuksel and Yuksel 2007), theme parks (Bigné, Andreu and Gnoth 2005), holidays (Hosany and Prayag 2013), heritage sites Prayag, Hosany and Odeh 2013), picturesque tourist attractions (e.g. L. Wang and Lyu 2019) and adventure tourism (Faullant, Matzler and Mooradian 2011). Emotions affect different phases of the tourist experience. In the pre-travel phase, emotions activate tourist motivation and inputs into destination selection processes (Gnoth 1997). During travel, emotions change from day to day (Nawijn et al. 2013). Tourist emotional reactions are precursors to pleasure (Faullant et al. 2011; Hosany et al. 2017), destination attachment (Yuksel, Yuksel, & Bilim 2010), behavioral intent (Yuksel & Yuksel 2007; Prayag, Hosany, & Odeh 2013), and perceived overall image scores (Prayag et al. 2017). Recent research focuses on residents 'emotional responses to tourism development, tourism impacts, and support (Jordan, Spencer, & Prayag 2019; Ouyang, Gursoy, & Sharma 2017; Zheng et al. 2019a). The emotions experienced by residents are determinants of support for holding mega events (Ouyang, Gursoy and Sharma 2017) and stress related to tourism (Jordan, Spencer and Prayag 2019).

Research on travel and tourism relies on measures of emotions from the psychological literature. Thus, studies apply emotion self-assessment scales (Izard 1977; Mehrabian and Russell 1974; Plutchik 1980; D. Watson, Clark, & Tellegen 1988) to understand tourism experiences. Nevertheless, researchers question the applicability, reliability, and validity of psychological emotion measures in tourism studies (Hosany and Gilbert 2010; Lee and Kyle 2013). Thus, Izard's (1977) "Differential Emotions Scale" (DES), focusing on facial expressions, presents too many negative emotions. Hosany and Gilbert (2010) conclude that existing measures of emotion based on psychology are context-specific and fail to capture the specific characteristics of tourists and destinations. The applied method informs thinking, theory making and theory testing (Gigerenzer 1991). The right measures of emotion have important implications for understanding travel

experiences. Until recently, the tourism literature neglected measurement issues related to the operationalization of emotions.

Emotions and Climate Change

We think of climate change as slow, but it is unnervingly fast. We think of the technological change necessary to avert it as fast-arriving, but unfortunately it is deceptively slow, especially judged by just how soon we need it. (Wallace-Wells, D., 2019)

Climate and weather are important factors for tourists and have an important impact on the global tourism sector (Scott et al. 2008; Dwyer et al. 2009; Gössling et al. 2016; Mushawemhuka et al. 2018). In 1991, a British survey found that 73% of respondents considered "good weather" to be the main reason for foreign tourism (Mintel International Group 1991). Changes in weather patterns as a result of climate change will have widespread consequences for tourism demand (Hübner and Gössling 2012). Climate and weather affect tourist satisfaction and intentions to revisit (Scott et al. 2008; Kim et al. 2017; Jeuring 2017; Caldeira and Kastenholz 2018). Curnock et al. (2019) analyzed the relationship between tourists 'emotions, perceptions of threats and values related to their attitude towards climate change. According to TripAdvisor reviews, the climate and weather of a tourist destination influence the choice of tourists and the enjoyment of that destination (Fitchett and Hoogendoorn 2018). While an increasing number of studies address the potential impacts of climate change on tourism, little is known about how the tourism sector accesses, uses, and analyzes available weather and climate information (Nalau et al. 2017). Through existing research on climate and weather perception of tourists, data sources come primarily from field surveys, and online reviews are less commonly used.

In recent years, user-generated content (UGC) provided by tourists on social networks has become an important source of information influencing tourism development (Capatina et al. 2018). Compared to traditional research data, big data sources such as UGC have gained popularity in tourism research due to their large scale, diversity, high speed, authenticity, initiative and low cost (IBM 2016; Fuchs et al. 2014; Alaei et al. 2017

Thus an analysis of China having a diverse climate and weather that varies from cold to tropical (Zhang 1991). Most areas are currently negatively affected by climate change. In 2018, the number of domestic tourists in China was 5.539 billion, and the number of outgoing 150 million, the first in the world (Finance Department of the Ministry of Culture and Tourism 2019). In recent years, the number of monthly active users on China's social media platform Sina Weibo has surpassed Twitter, making Sina Weibo the world's largest independent social media company (Sina Technology 2017). Tourists are happy to share their travel experiences on social media (Alaei et al. 2017). In short, China has a wealth of social media data to study tourists 'perceptions of climate.

The research mainly used the semi-supervised artificial neural network (ANN) machine learning method to analyze tourists 'perceptions of climate perception. The analysis is based on comments related to climate and weather on Sina Weibo regarding 229 representative picturesque Class 5A sites in mainland China. This study attempts to answer the following questions. Relying on the theory of cognitive evaluation and the method of emotion analysis, we construct a framework that uses climate data (continuous and stable) and weather (short-term and irregular) to analyze tourists' perceptions of climate. Given the different values attributed to environmental issues due to the different cultural backgrounds of tourists, there may be discrepancies in climate perception (Scott et al. 2008; Wilkins et al. 2017); therefore, based on the microscopic data of the pictorial area, what characteristics and patterns do the maps of the perception of the tourist climate at the macro- and meso-level have? Do these perceptions reflect the climate of the entire region, including destinations?

"The Earth is a fine place and worth fighting for,"- E. Hemingway.

Climate change is a frightening and complex threat that can lead to disturbing emotions, such as anxiety, depression, sadness and hopelessness. Because climate change is a long-term threat, we need to learn to deal with the potentially difficult emotions they can cause to ensure our well-being over time. If we learn to manage these feelings, we can recognize them as signs of our compassion and connection to the world around us, and use them as important motivators for action on climate change.

Strategies for adapting to climate-related troubles point us to three types of strategies for adapting to our climate-related troubles: strategies for acting through our emotions; strategies for transition to climate action;

and strategies to help reshape the problem and find hope. We need to learn to recognize that these feelings are normal and adaptable in response to such a threat, and can serve as powerful motivators for climate action. To maintain well-being faced with this long-term threat, it is important to participate in strategies to deal with these difficult emotions, including connecting with our feelings, using them to motivate us to act, and finding sources of hope.

Artificial Intelligence ; some examples; smart assistants

Scientific technique has demonstrated high-quality results for the intelligent automation tourism with sustainable environmental and social governance. The idea started from the broad research agenda and then systematically constructed knowledge in the area of artificial intelligence perspective, and its relationship with intelligent automation tourism, as well as conducting robust scientific research to advise policy measures and efforts from diverse stakeholder groups, such as governments and tourism organizations, to confirm the answerable adoption of intelligent automation in tourism. The scientific analysis proposes multiple survey preferences based on key scientific inquiries about artificial intelligence, associated automated technology, and their implementations in tourism. However, constructing beneficial artificial intelligence, facilitating adoption, examining the implications of intelligent automation, and establishing a sustainable vision with the help of ESG (environmental, social, and governance) criteria could be a good framework for the tourism sector. The outcome of predictive model leads to the conclusion that artificial intelligence design can improve tourism department if the intelligent automated framework was applied to it. This is because artificial intelligence, internet of things, facilitation adoption, and sustainable ESG had a predictive association found with intelligent automation in tourism.

The combination of artificial intelligence is key to building intelligent automated technologies for the future sustainability of tourism. Multidisciplinary perspectives operate in tourism and its relationship to the automation of artificial intelligence, such as psychology, anthropology, behavioral science, business studies and human-computer interaction (HCI), as well as design research methodologies such as cyber thinking (Martelaro and Ju , 2018; Tuomi et al., 2019), speculation technique (Wong, 2018), prototyping (van Allen, 2018), ESG factors for the travel and tourism industry (Ionescu et al., 2019) and multidisciplinary an approach with artificial intelligent automation that can be helpful to the tourism field (Churchill et al., 2018). Creating an unforgettable travel experience requires careful choreography of many components based on in-depth knowledge of the needs of tourists (Tussyadiah, 2014). Designing tourist experiences means considering the entire trip, from planning to thinking after the trip, and focusing on ways to encourage participation and involvement. Explaining the role of artificial intelligence in improving, increasing or replacing tourist encounters is crucial in the context of user experiences (Lindvall et al., 2018). ESG investing in artificially intelligent tourism may be possible with the Internet of Things (IoT). The development of criteria for functional artificial intelligence systems has been supported by various behaviors for systems dealing with specific problems and tourist contact points.

Designing valuable artificial intelligence from a technological standpoint necessitates highlighting the necessity of critical artificial intelligence (Russell et al., 2015; Tadapaneni, 2020). Robustness against requirements, exploits, defects, and cyberattack risks are all factors to consider (He et al., 2019; Luo et al., 2020; Shao et al., 2020; Fan et al., 2021; Khan et al., 2021; Wang et al., 2021). Russell et al. (2015) emphasize the necessity of verification in the form of «correct system design" and also validation with correct system design, which was also argued earlier by Menzies and Pecheur (2005). The first point to be considered is that the AI systems need access to a vast quantity of data; in tourism, these data mainly comprise personal information collected from tourists. ESG criteria should be built to make the most out of data while causing the least amount of intrusion into people's privacy and a feasible environment (Lords, 2018; Sethu, 2019; Tussyadiah et al., 2019). Techniques may address this problem to data anonymization and de-identification in the tourism department (Garfinkel, 2015; Khalila and Ebner, 2016). The second predictive stage focuses on the developers' perspectives, consumers, and the regulators' need to comprehend and justify artificial intelligence for any industry (Lords, 2018; Monroe, 2018). Another area of study should be improving artificial intelligence's technological openness and decreasing prejudice, which is essential for the future. In the third stage, building artificial intelligence with the perspective of IoT to solve security challenges necessitates the development of guidelines to guide behavior in safety-critical circumstances, identify infiltration and possible exploitation, and avoid hazardous occurrences (Russell et al., 2015). Finally, given the autonomy of these systems, research should be performed on how to maintain some meaningful human control. AI autonomy involves putting notions like «human in the loop" or «human on the loop" into

action and relationships with social agent (Dautenhahn, 1998; Schirner et al., 2013; Lugrin, 2021; Schoenherr, 2021).

Over the years, the influence of artificial intelligence (AI) has spread to nearly every aspect of the travel and hospitality industry. 30% of hospitality companies are using AI to improve their sales processes, websites and product personalization.

The proliferation of AI in the travel and hospitality industry can be attributed to the enormous amount of data generated today. AI can analyze data from obvious sources, add value by assimilating patterns of images, voice, video, and text, and transform them into meaningful, actionable information for decision making. Trends, outliers and patterns are determined using machine learning based algorithms that help guide a travel or hospitality company to make informed decisions.

There are always a few pioneers who are ready to take on a new challenge and embrace exponential new age technologies. Many hotel chains have started using an AI powered bot. Connie from Hilton Worldwide, the first true AI-powered concierge robot, is a good example. Connie stands two feet tall and guests can interact with him as they check in. Connie is powered by IBM's Watson AI and uses the Way Blazer travel database. It can provide customers with succinct information about local attractions, places to visit, etc. Since the AI is driven by a self-learning capability, it can learn and adapt and respond to each guest in a personalized manner.

In the travel space, Mezi, which uses AI with natural language processing technology, provides a personalized experience for business travelers, who are usually short on time. The idea is to introduce a "bleisure" (business+leisure) concept to meet the needs of the workforce. The company's research shows that 84% of business travelers return frustrated, exhausted and unmotivated. The type of tedious and monotonous planning that goes into booking the trip could be the reason. With AI and NLP, Mezi gathers individual preferences and generates personalized suggestions to provide a tailored, streamlined experience and properly address any issues encountered.

Increasing productivity now starts with hotel search, and the use of sophisticated AI has given the customer access to more data than ever before. Booking sites like Lola.com provide on-demand travel services and have developed algorithms that can not only instantly connect people to their team of travel agents who find and book flights, hotels, and cars, but have also been able to equip their agents with amazing technology to help with research and decisions.

Conclusion

Climatic conditions are considered a key resource of tourism (Dogru et al., 2019). As the effects of climate change are mainly seen in nature and landscapes, industries such as the tourism sector that rely on nature are severely affected. Tourism relies on suitable weather conditions in an area (sun, mild temperatures) to give tourists a pleasant experience (Atasoy and Atasoy, 2020). The coast or sea holiday industry is a popular sector in the tourism sector. This modality largely depends on the aesthetics of the coast and the living room, a time that could attract tourists. However, rising sea levels caused by rising global temperatures pose a threat to coastal tourism. In addition, changes in precipitation will affect the time available for tourists to enjoy the sea. This has been observed in sub-Saharan Africa where South African beaches are affected by climate change (Friedrich et al., 2020). Extreme events such as typhoons and cyclones on the one hand and heavy rainfall on the other can threaten the infrastructure that coastal tourism depends on.

An increase in temperature is believed to be associated with a decrease of snowfall (Bormann et al., 2018), and the retreat of glaciers, as well as further degradation due to the expansion of other land uses such as agriculture. In addition to includes various snow-dependent activities such as skiing or Nordic walking, very popular with tourists. Some studies have shown that the winter tourism industry will experience a drop in demand of approximately 64% if global temperatures continue to rise during skiing. If snowfall decreases only at the beginning and end of the ski season, an 18% drop in demand will be visible. These figures were generated after an estimate from 53 ski resorts in Austria that is popular for ski / snow tourism (Steiger et al., 2020).

Areas that rely on flora and fauna for tourism are also affected. This is due to the extreme temperatures that result in drought and thus reduced biodiversity and animal health. Specifically, this is seen in areas like Africa where wildlife parks are located experiencing adverse effects due to extreme weather conditions. In the Kruger National Park in South Africa, the costs of dealing with the effects of climate change in terms of

or conserving wildlife and the environment have increased. Furthermore, the tourist infrastructure was damaged due to harsh weather conditions. Researchers have proposed reconsidering the country's use planning, redesigning and strengthening existing parks and infrastructure and conservation techniques to build climate resilience (Dube and Nhamo, 2020). In other cases, elevated temperatures facilitate evapotranspiration and cause stress from moisture and lack of water (Naumann et al., 2018) a trend seen in many popular tourist destinations. Extreme drought in Cape, tourist destinations, southern Africa 2015-2017. One example was the extreme drought in the western Cape in the south (Otto et al., 2018). Huge water shortages in the area have resulted in a reduction in the number of tourists who view the area negatively. There has been a reduction in tourist spending and tickets to hotels that occurred after the drought began. Rainfall reductions are expected to recur in the future, forcing the tourism sector to increase water-saving measures (Dube et al., 2020). Decreased water availability has also been observed in the Mediterranean region (Roson and Sartori, 2014). Wine tourism has gained popularity over the years and increased rural development immensely. Although such tourism largely depends on social events, visits to cellars and wine consumption, much of it is related to the real glory of grapes. However, due to climate change, wine production is recording variable growth (Irimia et al., 2018). Most wine tourism takes place outdoors, which is not always possible due to erratic weather conditions (Sottini et al., 2021).

Emotion research has important findings for neurological marketing, local neural complexity is sensitive to affective valence assessment, while regional levels of neuro-cortical connectivity are sensitive to affective arousal assessments (Aydın, 2019). There is a mechanism for processing attention bias for emotions. Some research has shown that angry faces can automatically trigger attention, that is, there is an effect of anger dominance. Some studies have shown the existence of a happiness dominance effect (Xu et al., 2019). Most psychologists consider subjective experiences to be a central component of emotions, emphasizing the role of consciousness in emotional production and emotional state. However, discussing emotional issues from the perspective of unconscious emotions has a deep tradition in psychological research. Unconscious emotion, called subliminal emotion, refers to the change in thoughts and emotions caused by certain emotional states (Li and Lv, 2014). This emotional state is independent of his conscious consciousness, and the induction of that emotional state is unconscious (Jiang and Zhou, 2004; Wataru et al., 2014; Zheng et al., 2021a). Subliminal representation of stimuli is an important research topic in the field of unconscious perception.

The 21st century brings travelers looking for different experiences, and they are not just interested in places. Traditional researchers as tourists have been replaced by those of the digital age and they are actors in a global movement that aims to learn through experience. Therefore, people establish their own reality, as they are created live dissolved in the current present, true experiences. More and more tourism is associated with knowledge, learning and assessment. The tourist who experiences is not passive but is involved, interactive, critical and creative. Our age is seen as new: an age of the economy of experience in which consumers seek extraordinary and memorable experiences. The journey itself becomes important, not just a destination because the emotional level is what travelers are looking for: a good connection to places. They will understand more, appreciate alternative lifestyles, find the beauty of natural landscapes, look for activities that appeal to niche personal interests (Quintanilla, 2018) Every experience is different and has different psychological effects. The experience of positive emotions with purpose in life about some activities will be remembered for the rest of your life (Taylor 2018).

The proliferation of AI in the travel and hospitality industry can be attributed to the huge amount of data that is generated today. AI can analyze data from obvious sources, add value by assimilating patterns of images, voice, video, and text, and transform it into meaningful, effective decision-making information. Trends, deviations, and patterns are determined using machine learning-based algorithms that help guide a travel or hospitality company in making informed decisions.

Digital Generation Y will pay for unusual but appealing experiences. They are used to having the information they need using smart smartphones that are always with them. They have learned that there are no secrets for them, they can find out everything because they know how to search. They are more educated and inclined to travel, they have a better taste for everything, they are more open to globalization. They combine perfect experiences with personalization paying attention to all the details. And that helps them choose the right destinations. Although we live in a divided world (cracks within policies), economic global prosperity will imply growth in the tourism industry and companies will invest in innovation to reach more tourists through mobile channels.

The tourist has entered a new era of technology and innovation with impact by changing the way he plans, records or evaluates experiences. Everything he shares is in a social media-driven world, where it's up to each of us how we do it. Tourism will continue to be one of the main drivers of the world economy. New destinations have increased competition, the consumer profile has changed: he is more informed, in direct interaction, in search of new experiences that will remain unique for the rest of his life, no matter where he decides to travel.

Understanding today's tourism in uncertain conditions, climate challenges and survival in the modern world requires an interdisciplinary path and ultimately with the final thought "We are humans who want the same thing every other human wants - a safe place to live on this planet we call home. So while our work must continue to be unbiased and objective, increasingly we are raising our voices, adding to the clear message that climate change is real and humans are responsible, the impacts are serious and we must act now". (Katharine Hayhoe, Climate Scientist)

Maybe a few more dashes for the end on thermodynamics and financial decision making. The thermodynamic perspective of decision-making clarifies that preference for safety and aversion to losses (Kahneman and Tversky, 1979) show that free energy is a nonlinear, essentially discontinuous function of a quantized process. Laboratory tests can be prepared against someone's life experience, ie holistic thinking about causes and consequences. The tests can be adjusted to deviate from the characteristic indeterminate flows of natural processes that participants anticipate. To deceive means to divert attention. Lack of information, as well as excess, can be misleading if judged if you think about it. In thermodynamic terms, the system did not have enough resources to consider all the forces before making a decision. The system, in fact, considered more, but in an unconscious way. Decisions are made based on feelings when there is not enough time and energy to weigh the pros and cons and to explicitly assess scenarios. In a crisis, immediate action compensates for investing in decision-making. When in trouble, easier and direct ways are preferable to hard and sophisticated ways (Fiske and Taylor, 1991). Free energy is limited, therefore, rationality is limited (Simon, 1955). Paralysis analysis can be rationalized in a thermodynamic sense. Infinite analysis corresponds to a metastable state. The system balances between options. Gains in free energy consumption by one decision or another are marginal or seemingly disproportionate, and therefore do not provide a clear incentive for one or the other. Since natural processes are unsolvable, it is impossible to know in advance under what circumstances paralysis occurs. Well, the descriptive descriptive theory of decision-making, as well as the rational one, lacks universality. The model explains the phenomenon, but fails to generalize the phenomena. From a thermodynamic perspective, the subjective and indeterminate characters of the natural process prevent the derivation of a universal model. Even so, decision-making is not arbitrary, but produces universal patterns as it is limited by free energy, channeled by mechanisms, and driven by the imperative of least time.

Theory is needed to understand the data. But the data itself is already burdened with theory because theories influence data collection (Kuhn, 1962). The very attempt to understand the meaning of decision-making narrows down experiments and biased interpretations of behavior as rational - ultimately focusing on what rationality means. Although these preconditions and qualities of the theory (Popper, 2002) have been recognized, it is not clear on which axioms modern decision-making research rests. On the one hand, studies of mutated mice, fruit flies, and nematodes link neural networks and molecular mechanisms with behavior down to brilliant detail (Yapici et al., 2014; Tanimoto and Kimura, 2019). Yet the central aspect of science, causality, remains unclear: do molecular structures and neural networks facilitate behavior or force it? What basically motivates decisions? Why do we decide the way we work? By incorporating neuroscience and the spectrum of emotions in addition to quantum physics, it seeks additional research and efforts to move beyond standard frameworks.

References

1. Abeles M. (1991). Corticonics: Neural Circuits of the Cerebral Cortex. Cambridge Univ. Press, New York. [Google Scholar]
2. Aho, S. K. (2001). Towards a General Theory of Touristic Experiences: Modeling Experience Process in Tourism. Tourism Review, *56*(3), 33–37. [Link]
3. Annila, A. (2021). The matter of time. *Entropy*, *23*(8), 943. [CrossRef]

4. Annila, A., and Salthe, S. (2010). Physical foundations of evolutionary theory. J. Non Equilib. Thermodyn. 35, 301–321. [Link]
5. Apanasenko G.L. (2015). the Individual health: in search of essence and quantitative estimation. *Envirenment and health*. 3, 8-12. [Link]
6. Apanasenko G,L., Popova L.A. (1998). Medical valeology. Kyiv Health, 238. [Link]
7. Apanasenko G.L. (1990). Thermodynamics conception of health and prophylaxis. Ground. archive 12: 56-58. [Link]
8. Apanasenko G.L. (2014). Biological degradation of Homo Sapiens : ways of counteraction. Palmarium acad. Publ., Saarbruken 102. [Link]
9. Ariely, D. (2008). Predictably Irrational: The Hidden Forces that Shape Our Decisions. New York, NY: HarperCollins. [Link]
10. Attwell D. & Laughlin, S. B. (2001) J. Cereb. Blood Flow Metab.21,1133-1145. [Link]
11. Ball, P. (2014). Critical Mass. New York, NY: Random House. [Link]
12. Bauer E. (1935). Theoretical biology. L:VIEM. 157. [Link]
13. Bennet, A., and Bennet, D. (2008). The decision-making process in a complex situation, in Handbook on Decision Support Systems 1: Basic Themes, eds F. Burstein and C. W. Holsapple, *Springer*, 3–20. [Link]
14. Bigné, J. E., Andreu, L., Gnoth, J. (2005). The Theme Park Experience: An Analysis of Pleasure, Arousal and Satisfaction. Tourism Management, *26*(6), 833-44. [Link]
15. Boltzmann, L. (1905). Populäre Schriften. Leipzig: Barth. [Link]
16. Braitenberg V. & Schuz, A., (1998) Cortex: Statistics and Geometry of Neuronal Connectivity, *Springer*, New York. [Link]
17. Busemeyer, J. R., and Bruza, P. D. (2012). Quantum Models of Cognition and Decision. Cambridge: Cambridge University Press. [Link]
18. Buzzell, L., & Chalquist, C. (2009). Ecotherapy: Healing with Nature in Mind (L. Buzzell & C. Chalquist (eds.). Counterpoint. [Link]
19. Callen, H. B. (1991). Thermodynamics and an Introduction to Thermostatistics. New York, NY: Wiley. [Link]
20. Carbon Conversation Toronto (CCTO). [Link]
21. The Work that Reconnects Network. [Link]
22. Eco-anxious stories. [Link]
23. Clayton, S. (2020). Climate anxiety: Psychological responses to climate change. Journal of Anxiety Disorders, 74, 102263. [CrossRef]
24. Clayton, S., & Karazsia, B. T. (2020). Development and validation of a measure of climate change anxiety. *Journal of Environmental Psychology*, 69, 101434. [CrossRef]
25. Churchill, E. F., van Allen, P., and Kuniavsky, M. (2018). Special Topic: Designing AI: Introduction. Interactions, *25*(6), 34–37. [Link]
26. Contreras-Reyes, J. E. (2021). Fisher information and uncertainty principle for skew-gaussian random variables. Fluct. Noise Lett. 20:2150039. [Link]
27. Curnock, M., and Coauthors, 2019: Shifts in tourists' sentiments and climate risk perceptions following mass coral bleaching of the Great Barrier Reef. Nat. Climate Change, 9, 535–541, [CrossRef]
28. Dautenhahn, K. (1998). The Art of Designing Socially Intelligent Agents: Science, Fiction, and the Human in the Loop. Appl. Artif. Intelligence, 12, (7-8), 573–617. [Link]
29. Davenport, L. (2017). Emotional Resiliency in the Era of Climate Change: A Clinician's Guide. Jessica Kingsley Publishers. [Link]
30. Dutton, T. (2018). Politics of AI, an Overview of National AI Strategies. [Link]
31. Fingelkurts, A. A., and Fingelkurts, A. A. (2014). Present moment, past, and future: mental kaleidoscope. Front. Psychol, 5, 395. [Link]
32. Faullant, R., Matzler, K., Mooradian, T. A. (2011). Personality, Basic Emotions, and Satisfaction: Primary Emotions in the Mountaineering Experience. *Tourism Management*, *32*(6), 1423–30. [Link]
33. Fiske, S. T., and Taylor, S. E. (1991). Social Cognition. New York, NY: McGraw Hill. [Link]
34. Fitchett, J., and G. Hoogendoorn. (2018). An analysis of factors affecting tourists' accounts of weather in South Africa. Int. J. Biometeor, 62, 2161–2172. [CrossRef]
35. Garfinkel, S. L. (2015). De-identification of Personal Information, in NISTIR 8053. De-identification of Personal Information (Gaithersburg, Maryland, USA: National Institute of Standards and Technology, US Department of Commerce). [Link]

36. Geiger, N., Swim, J. K., & Fraser, J. (2017). Creating a climate for change: Interventions, efficacy and public discussion about climate change. Journal of Environmental Psychology, 51, 104–116. [CrossRef]

37. Gnoth, J. (1997). Tourism Motivation and Expectation Formation. *Annals of Tourism Research*, *24*(2), 283–304. [Link]

38. Gigerenzer, G. (1991). From Tools to Theories: A Heuristic of Discovery in Cognitive Psychology. *Psychological Review*, *98*(2), 254–67. [Link]

39. Greenleaf, A. T., Bryant, R. M., & Pollock, J. B. (2014). Nature-Based Counseling: Integrating the Healing Benefits of Nature Into Practice. *International Journal for the Advancement of Counselling*, *36*(2), 162–174.[CrossRef]

40. He, H., Li, S., Hu, L., Duarte, N., Manta, O., and Yue, X.-G. (2019). Risk Factor Identification of Sustainable Guarantee Network Based on Logistic Regression Algorithm. *Sustainability*, *11*(13), 3525. [Link]

41. Homer-Dixon, T. (2020). Commanding Hope. Penguin Random House Canada. [Link]

42. Hosany, S. (2012). Appraisal Determinants of Tourist Emotional Responses. *Journal of Travel Research, 51*(3), 303–14. [Link]

43. Hosany, S., Gilbert, D. (2010). Measuring Tourists' Emotional Experiences toward Hedonic Holiday Destinations. *Journal of Travel Research*, *49*(4), 513-26. [Link]

44. Hosany, S., Prayag, G. (2013). Patterns of Tourists' Emotional Responses, Satisfaction, and Intention to Recommend. *Journal of Business Research, 66*(6), 730–37. [Link]

45. Hübner, A., and S. Gössling, 2012: Tourist perceptions of extreme weather events in Martinique. J. Destin. Market. Manage, 1, 47–55.[CrossRef]

46. Ionescu, G. H., Firoiu, D., Pirvu, R., and Vilag, R. D. (2019). The Impact of ESG Factors on Market Value of Companies from Travel and Tourism Industry. Technol. Econ. Dev. Economy, *25*(5), 820–849. [Link]

47. Izard, E. E. 1977. Human Emotions. New York: Plenum Press. [Link]

48. Jaynes, E. J. S., Ray, C., and Grandy, W. J. (1985). Maximum Entropy and Bayesian Methods in Inverse Problems. Dordrecht: D. Reidel Publishing Company, 21. [Link]

49. Jeuring, J. H. G., 2017: Weather perceptions, holiday satisfaction and perceived attractiveness of domestic vacationing in the Netherlands. *Tourism Management*, 61, 70–81, [CrossRef]

50. Jordan, E. J., Spencer, D. M., Prayag, G. 2019. "Tourism Impacts, Emotions and Stress." Annals of Tourism Research, 75, 213-226. [Link]

51. Kelsey, E. (2020). Hope Matters: Why Changing the Way We Think Is Critical to Solving the Environmental Crisis. Greystone Books. ISBN: 9781771647779. [Link]

52. Lee, J., Kyle, G. T. (2013). The Measurement of Emotions Elicited within Festival Contexts: A Psychometric Test of a Festival Consumption Emotions (FCE) Scale. *Tourism Analysis 18*(6), 635-49. [Link]

53. Limpert, E., Stahel, W., and Abbt, M. (2001). Lognormal distributions across the sciences: keys and clues. Bioscience, 51, 341–352. [Link]

54. Lindvall, M., Molin, J., and Löwgren, J. (2018). From Machine Learning to Machine Teaching. Interactions. *25*(6), 52–57. [Link]

55. Martelaro, N., and Ju, W. (2018). Cybernetics and the Design of the User Experience of AI Systems. Interactions, *25*(6), 38–41. [Link]

56. Mäkelä, T., and Annila, A. (2010). Natural patterns of energy dispersal. *Phys. Life Review*, 7, 477–498. [Link]

57. Menzies, T., and Pecheur, C. (2005). Verification and Validation and Artificial Intelligence. Adv. Comput. 65, 153–201. [Link]

58. Nalau, J., S. Becken, S. Noakes, and B. Mackey, 2017: Mapping tourism stakeholders' weather and climate information-seeking behavior in Fiji. Wea. Climate Soc., 9, 377–391. [CrossRef]

59. Nawijn, J. (2011). Determinants of Daily Happiness on Vacation. *Journal of Travel Research, 50*(5), 559-566. [Google Scholar]

60. Nawijn, J., Biran, A. (2019). Negative Emotions in Tourism: A Meaningful Analysis. Current Issues in Tourism, *22*(19), 2386–98. [Google Scholar]

61. Nawijn, J., Mitas, O., Lin, Y., Kerstetter, D. (2013). How Do We Feel on Vacation? A Closer Look at How Emotions Change over the Course of a Trip. *Journal of Travel Research*, 52(2), 265-74. [Google Scholar]

62. O'connor, T., and Franklin, C. (2021). Free will in The Stanford Encyclopedia of Philosophy, ed. E. N. Zalta (Stanford, CA: Stanford University). [Google Scholar]

63. Ojala, M. (2012). Regulating worry, promoting hope: How do children, adolescents, and young adults cope with climate change? *International Journal of Environmental & Science Education*, *7*(4), 537–561. [Google Scholar]

64. Ouyang, Z., Gursoy, D., Sharma, B. (2017). Role of Trust, Emotions and Event Attachment Residents' Attitudes toward Tourism. *Tourism Management*, 63, 426–38. [Google Scholar]

65. Popper, K. R. (2002). The Logic of Scientific Discovery. Abingdon: Routledge. [Google Scholar]

66. Prayag, G., Hosany, S., Muskat, B., Del Chiappa, G. (2017). Understanding the Relationships between Tourists' Emotional Experiences, Perceived Overall Image, Satisfaction, and Intention to Recommend. *Journal of Travel Research*, *56*(1), 41–54. [Google Scholar]

67. Prayag, G., Hosany, S., Odeh, K. (2013). The Role of Tourists' Emotional Experiences and Satisfaction in Understanding Behavioral Intentions. *Journal of Destination Marketing & Management*, *2*(2), 118-127. [Google Scholar]

68. Roy, Inori. (2021, July 24). Shaking up the stereotypes about Ontario's outdoors. The Narwhal. [Link]

69. Russell, S., Dewey, D., and Tegmark, M. (2015). Research Priorities for Robust and Beneficial Artificial Intelligence. AIMag 36 (4), 105–114. [Google Scholar]

70. Schrodinger Erwin. (1944). What is life? The physical aspect of the living cell. Cambridge Univ. Press: 92. [Link]

71. OpenStax, College Physics. OpenStax CNX. (2019). [Link]

72. Sibson N. R., Dhankhar, A., Mason, G. F., Rothman, D. L., Behar, K. L. & Shulman, R. G. (1998). Stoichiometric coupling of brain glucose metabolism and glutamatergic neuronal activity, 95, 316-321. [Link]

73. Simon, H. A. (1955). A behavioral model of rational choice. Q. J. Econ. 69, 99–118. [Link]

74. Scott, D., S. Gössling, and C. R. D. Freitas, 2008: Preferred climates for tourism: Case studies from Canada, New Zealand and Sweden. Climate Res., 45, 61–73. [CrossRef]

75. Tuisku, P., Pernu, T. K., and Annila, A. (2009). In the light of time. Proc. R. Soc. A Math. Phys. Eng. Sci. 465, 1173–1198. [Link]

76. Tussyadiah, I. (2020). A Review of Research into Automation in Tourism: Launching the Annals of Tourism Research Curated Collection on Artificial Intelligence and Robotics in Tourism. Ann. Tourism Res. 81, 102883. [Link]

77. Tussyadiah, I., Li, S., and Miller, G. (2019). Privacy Protection in Tourism: Where We Are and where We Should Be Heading for. Inf. Commun. Tech. tourism, 278–290. [Link]

78. Tussyadiah, I., and Miller, G. (2019). Nudged by a Robot: Responses to agency and Feedback. Ann. Tourism Res. 78, 102752. [Link]

79. Tussyadiah, I. P., and Park, S. (2018). Consumer Evaluation of Hotel Service Robots, in Information and Communication Technologies in Tourism, *Springer*, 308–320. [Link]

80. Tussyadiah, I. P. (2017). Technology and Behavioral Design in Tourism, in Design Science in Tourism *Springer*, 173–191. [Link]

81. Tussyadiah, I. P. (2014). Toward a Theoretical Foundation for Experience Design in Tourism. J. Trav. Res. *53*(5), 543–564. [Link]

82. van Allen, P. (2018). Prototyping Ways of Prototyping AI. Interactions, *25*(6), 46–51. [Link]

83. Wang, K.-H., Xiong, D.-P., Mirza, N., Shao, X.-F., and Yue, X.-G. (2021). Does Geopolitical Risk Uncertainty Strengthen or Depress Cash Holdings of Oil Enterprises? Evidence from China. Pacific-Basin Finance J. 66, 101516. [Link]

84. Wang, M., and Wu, D. (2021). ICT-based Assistive Technology as the Extension of Human Eyes: Technological Empowerment and Social Inclusion of Visually Impaired People in China. Asian J. Commun. *31*(6), 470–484. [Link]

85. Wang, Y. J., Minor, M. S. (2008). Validity, Reliability and Applicability of Psychophysiological Techniques in Marketing Research. *Psychology & Marketing*, *25*(2),197–232. [Link]

86. Wohrer, A., Humphries, M. D., and Machens, C. K. (2013). Population-wide distributions of neural activity during perceptual decision-making. Prog. Neurobiol. 103, 156–193. [Link]

87. Wolpert, D. H. J. A. (2004). Information Theory - The Bridge Connecting Bounded Rational Game Theory and Statistical Physics. Genre: Bibliogov. [Link]

88. Wong, J. S. (2018). Design and Fiction: Imagining Civic AI. Interactions, *25*(6), 42–45. [Link]

89. Whyte, K. (2017). Indigenous Climate Change Studies: Indigenizing Futures, Decolonizing the Anthropocene. English Language Notes, *55*(1), 153-162. [Link]
90. Yapici, N., Zimmer, M., and Domingos, A. I. (2014). Cellular and molecular basis of decision-making. EMBO Rep. 15, 1023–1035. [Link]
91. Yuksel, A., Yuksel, F. (2007). Shopping Risk Perceptions: Effects on Tourists' Emotions, Satisfaction and Expressed Loyalty Intentions. *Tourism Management*, *28*(3), 703–713. [Link]
92. Yuksel, A., Yuksel, F., Bilim, Y. (2010). Destination Attachment: Effects on Consumer Satisfaction and Cognitive, Affective and Conative Loyalty. *Tourism Management, 31*(2), 274–84. [Link]
93. Zheng, D., Ritchie, B. W., Benckendorff, P. J., Bao, J. (2019a). The Role of Cognitive Appraisal, Emotion and Commitment in Affecting Resident Support toward Tourism Performing Arts Development. *Journal of Sustainable Tourism*, *27*(11), 1725–44. [Link]
94. Zheng, D., Ritchie, B. W., Benckendorff, P. J., Bao, J. 2019b. "Emotional Responses toward Tourism Performing Arts Development: A Comparison of Urban and Rural Residents in China." Tourism Management 70 (February): 238–49.