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# ***Determinism of human behavior: an hypothesis on social and individual behavior as a universal complex system***

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**Abstract** This paper defends the thesis that human behavior follows a determinist structure analogous to the behavior of complex systems in physics. The determinism of behavior does not make it predictable due to the number of variables that shape individual behavior. The incest taboo is presented here as a case study of an evolutionary behavior, whose biological framework shapes, hence, determines, in part, its social meaning(s). Social sciences' contribution on human behavior, although helpful, do not fully account for every behavioral responses available in every situation. An evolutionary analysis of behavior shows better chances of comprehending human behavior when taken in a multidisciplinary approach. Behavior's determinism remains unpredictable, but probabilistic approaches based on multidisciplinary knowledge gathers the best chances for its accountability.

**Key words** Evolutionary behavior; classical physics; unpredictability; incest taboo; probability.

**Sumário** Este trabalho defende a tese de que o comportamento humano segue uma estrutura análoga ao comportamento de sistemas complexos em física. O determinismo do comportamento não o torna previsível devido ao número de variáveis que moldam o comportamento individual. O tabu do incesto é aqui apresentado como caso de estudo de comportamento evolutivo, cuja estrutura biológica molda, logo, determina, em parte, o(s) seu(s) significado(s) social(is). A contribuição das ciências sociais ao comportamento humano, apesar de assistir, não compreende extensivamente todas as respostas comportamentais disponíveis em todas as situações. Uma análise evolutiva do comportamento demonstra melhores hipóteses de compreender o comportamento humano quando aproximado multidisciplinarymente. O determinismo do comportamento mantém-se imprevisível, mas aproximações probabilísticas baseadas no conhecimento multidisciplinar produzem a melhor hipótese para a sua compreensão.

**Palavras-chave** Comportamento evolutivo; física clássica; imprevisibilidade; tabu do incesto; probabilidade.

## Introduction

The following pages will attempt to present human behavior as similar, even analogous, to the structure of complex systems' behavior analyzed in physics. This is what I mean by "universal" in the title. The goal is to demonstrate that human behavior, just like in a complex system, follows specific guidelines, physical laws that govern the Universe, and, consequently, a deterministic and irreversible pattern. It is an infinite cause and effect in a chaotic loop. (The chaotic loop refers to the 'creation' and 'destruction' of the universe through infinite cycles of 'big bangs' and 'big crunches', respectively.)

The incipient determinism of complex systems does not, however, permit predictability of the specific behavior of that system. That is, even though behavior has a determinist structure, it is not, by any means, predictable. The quantity of variables influencing a complex system's behavior is unaccountable. Also, the amount of complexity (the 'size' of a system) defines the type of interactions and behaviors of that same system. Despite the bodily effect of the proliferation of bacteria, a single specimen interacts at its own level while a colony of the same bacteria infects a larger organism. By the same token human behavior interacts solely with human behavior, but what influences a single individual's behavior at a given time may be that individuals' sociological process, historical particularism, or even a food allergy that affects his/her mood!

For the purpose of this paper, my arguments are presented in three parts. The first part will briefly show how the field of physics deals with complex systems (no equations are included unless they are absolutely required to exemplify their theoretical purpose); the second part demonstrates how there is evolutionary behavior that still influences modern human behavior and an analysis of incest throughout evolution; and the third part will present how social sciences have taken behavioral studies and some future possible research alternatives or addendums to behavior analysis.

## Part I

In this part there are a few ideas that must be present:

1. Determinism exists in simple systems;
2. The functioning of simple systems affects the functioning of larger, complex systems of which they are part of;
3. ‘N-body problem’ illustrates the mathematical impossibility of absolutely determining the behavior of ‘N-body’ systems, but it does not refute their absolute determinism;
4. Systems interact at levels that are directly correlated to their degree of complexity, that is, higher the complexity, the less or none interaction at lower levels (simple systems).

Newton’s *Principia Mathematica* introduced the concept of gravity and the three laws of motion (Ball, 2004; Gleick, 1987; Gribbin, 2004; Hawking, 1988; Prigogine, 1980; Prigogine and Stengers, 1984). These contributions formed what is called classic physics or dynamics. Classic physics describe the Universe as a determinist and, therefore, reversible system.

The first law (law of inertia) states that a body at rest or in motion will not change its state, trajectory or acceleration until an external force acts upon it. The second law (law of acceleration) refers to the change in acceleration of a body when a force acts on it. Finally, the third law (law of reciprocal actions) states that “for every force there is an equal and opposite force”. Together, these laws describe how two or more bodies interact.

Two bodies will exert forces upon one another, but the force each one has depends on its mass. Bodies of larger mass exercise larger force than smaller bodies. This explains how there are orbits in our solar system or in atoms (the nucleus of an atom has a higher mass than the electrons that orbit an atom; this is one of the forces exerted on electrons when they change between different atoms in chemical reactions with atoms of higher nucleus mass) and how we do not roam freely into space away from Earth.

Using Newton’s universal laws it is possible to accurately calculate the orbits between two bodies, but the same equations do not function when a third body is added. Calculating the interaction of two bodies at a time can make an approximation to their orbits, but this is only an approximation since one calculation does not account for the force exerted by the body not accounted in the equation. So, despite the mechanical, hence, determinist

structure of this system, its behavior cannot be predicted due to the forces that cannot be calculated in the interaction of the three bodies. Even if the three bodies have identical mass the system is still unpredictable. This is called the ‘three-body problem’ or the ‘N-body problem’ (Gribbin, 2004). There is no prediction possible on a three-body system’s behavior, only an approximation, and complex systems, such as human behavior, have a far greater number of “bodies” that compose them (Ball, 2004; Gleick, 1987; Gribbin, 2004; Hawking, 1988; Prigogine, 1980; Prigogine and Stengers, 1984). This version of the universe would suffice were it not for allowing the reversibility of events. In this case reversibility is achieved simply by the inversion in velocity of the bodies (Gleick, 1987; Gribbin, 2004; Prigogine, 1980; Prigogine and Stengers, 1984).

Aside from the force it has on others, a body also has a specific coordinate and velocity (sometimes referred to as *momentum*). A system can be predicted by understanding and specifically knowing its initial conditions and calculating its development, or by calculating its current coordinates and velocity. If the coordinates and velocity of a given body are known, one can infer on its past and future (Ball, 2004; Gribbin, 2004; Gleick, 1987; Hawking, 1988; Prigogine, 1980; Prigogine and Stengers, 1984). This works on a closed system where there are no other bodies that may interfere with it. A being gifted with the knowledge of coordinates and velocity for all the particles (bodies) in the universe has the ability to know the past and future of the whole universe. Laplace imagined such a being, known as Laplace’s Demon (Ball, 2004; Gleick, 1987; Gribbin, 2004; Hawking, 1988; Prigogine, 1980; Prigogine and Stengers, 1984). This is indeed an ambitious and anthropomorphic imagination on the hopes of science. This Demon is nothing but a scientist “endowed with sharper senses and greater powers of calculation” (Prigogine and Stengers, 1984).

However, these qualities (coordinate and velocity) can only be calculated one at a time. Therefore, when one knows where the particle is, one cannot know what is its speed and vice-versa. This is known as the Heisenberg’s Principle of Uncertainty (Ball, 2004; Gleick, 1987; Gribbin, 2004; Hawking, 1988; Prigogine, 1980; Prigogine and Stengers, 1984). As it has been pointed out (Welch, 2008), Heisenberg’s Principle of Uncertainty does not have a significant effect on a macroscopic scale, but it does affect chemical reactions’ results, such as the chemical reactions of a cell inside a brain. (The

‘malfunction’ in DNA code translation may cause an abnormal brain cell, hence causing a tumor and, therefore, affect and individual’s behavior.)

One more factor that contributes to the unpredictability of the Universe is the human constraint on infinitesimal numerical values. Fractions exist *ad infinitum* and the abbreviation of numerical values by scientists for the purpose of simplicity produces chaotic systems (Prigogine and Stengers, 1984). This has been exemplified in the ‘prediction’ of weather patterns (Gleick, 1987). By abbreviating results, the final values projected for a system may vary depending on the quantity of cycles towards which it is being calculated for. An abbreviation from a value like 10-23 to 10-20 would not derive much from the exact values of the system in analyses if the calculi exempt values with that high number of decimal cases. If the study, however, pretends to analyze a system’s behavior over a long period of time, abbreviating would result in ‘chaotic’ changes from what would be expected. Cyclically, the system would exhibit a ‘random’ behavior contrary to its equilibrium (Ball, 2004; Gleick, 1987; Gribbin, 2004; Prigogine and Stengers, 1984). This ‘random’ or ‘chaotic’ behavior may also be the result of the inability to account for all of a system’s influences, both internal and external. But this is a methodological issue rather than a theoretical one (Prigogine and Stengers, 1984).

So, complex systems have a pre-determined behavior based on the interaction of their composing simple systems, but their behavior (complex systems) is also influenced by the interaction with other complex systems. Their behavior is unpredictable due to the mathematical impossibility of calculating the absolute values of ‘n-systems’ interaction and the impossibility of apprehending the two required characteristics of particles for their ‘prediction’.

## Part II

Human behavior is the product of millions of years of biological evolution, as well as the product of millions of years of social evolution. The regular day-to-day behavior is the outcome of sociological processes produced by a specific culture and society in which the individual is born or reared in, as well as the product of the interaction between socialization processes and his/her biological composition (Alland, 1973; Cartwright, 2000).

Sociobiologists have related current behavior to its evolutionary counterpart and evolutionary purpose, having only a biological basis for the explanation of modern human behavior (Breuer, 1982; Sahlins, 1976). Sahlins (1976) refers to sociobiologists' perspective as being naïve, as a deconstructive interpretation of social and cultural meanings in human social acts such as warfare and food sharing. So, an important issue arises here: Are humans the product of solely biological adaptation limiting social evolution or has social adaptation shaped biological evolution in the advent of consciousness? Consciousness here implies the use of logical reasoning. Could a species' use of logical reasoning in transforming nature (for example, fabricating instruments) overcome its intrinsic biological restraints?

It is this consciousness, this ability for logical reasoning that I argue has a similar structure to the behavior of complex systems described in the first part.

The Classical School of Thought (Adler *et al.*, 1991) took behavior as the result of calculation of cost and benefit. In its simplest form, behavior is the outcome of a cost-benefit relation! This type of analysis is readily applied to simple behaviors ('do I dare climb that tree to feed on its fruits even though I could fall and hurt myself?'). As society becomes more and more complex, each individual's behavior becomes more complex as well, but it still remains that dialectical relation between cost and benefit, except with far more variables. It is not more complex due to the number of complex systems (the number of individuals) it interacts with, but the type of complex systems (emotional relations vs. economic relations) that it interacts with.

In this perspective, human behavior is similar to the behavior of simple systems described in Part I. Human behavior is the result of the calculus of two variables (cost/benefit vs. coordinate/velocity), and the number of factors that modify the variables increases with the increase of complexity.

However, the Classical School of Thought also posits the free will of an individual in his/her choice of actions (Adler *et al.*, 1991). On the other hand, if an individual's choice is made on the cost/benefit relation, in turn based on his/her own knowledge, memories and experiences, then the outcome is determined by his/her specific knowledge, memories and experiences. There is, therefore, an 'illusion of free will' between the time of thought and the time of action.

Human behavior has its framework on biological evolution, but the constructs that follow its biology are of a socio-cultural nature (Barash and

Waterhouse, 1981; Sahlins, 1976; Teixeira, 2006). One's behavior is constrained by the limits of his/her body while the variations on behavior for the same biological constraints show different cultural adaptations to selective pressures. It is not by mere chance that several authors refer to the Fertile Crescent as the birth of Civilization (Braidwood, 1952; Frankfort, 1956; Walters, 1965). The specific conditions and restraints of this region conditioned cultural adaptation. Theodosius Dobzhanski (1973) says "nothing in biology makes sense, except in the light of evolution" and the same applies to culture and society. Sixteenth and seventeenth century literature roam with several journals on the strange, abnormal and out of the ordinary practices observed outside of Europe (Pratt, 1992). Missionaries and travelers' accounts often report the rituals and practices of other cultures and societies (one must also understand that Europe was considered the most advanced region of those periods and that all valuable knowledge was, supposedly, of European minds) (Karam, 2000; Pratt, 1992). These accounts showed to Europeans the 'primitivism' of the rest of the world and assured them the high status of their own civilization.

As has been noted before, hunter-gatherer behavior was one of the first 'tactics' employed by our predecessors, but it does not mean that current hunter-gatherer societies represent a primitive culture. It simply shows how this pattern of behavior is well adapted to survival and ecological equilibrium in certain regions of our planet (Cartwright, 2000; Parker, 1976).

Human evolutionary behavior is not only observed in communal patterns of behavior, that is, in the behavior of entire communities. The structural-functionalism in ethnographies represented the communities at study in a mechanical way (see Evans-Pritchard, 1940; and Harris, 1974). Those communities' individuals would all behave in similar fashion due to the mechanical cultural production of meaning imprinted on them. All individuals behave the same because they were taught and live in the same environment. In this type of account innovation does not occur frequently, it takes a long time until it is culturally accepted and treated as traditional (Graburn, 2000). This type of approach denies the 'unpredictability of human stupidity'. It is this 'unpredictable stupidity' that is of paramount importance for evolutionary behavior. The social norms and values of those same communities have been shaped by social and cultural adaptation, and some of these social norms and values have a biological foundation or a behavioral counterpart in human ancestors and other animals (Cartwright, 2000), such as the incest taboo (Teixeira, 2006).



Incest taboo is ubiquitous in human societies (Héritier, 1989; Murdock, 1969; Teixeira, 2006). The only constant in this universality is the human component, a biological and social entity (Barash and Waterhouse, 1981; Bixler, 1981a; Teixeira, 2006). As Barash and Waterhouse (1981) put it, “[h]uman beings wear a wide array of clothes, but, as Bixler implies, there is always a recognizable human body inside; and part of that biologically given body of human behaviour appears to be incest avoidance.”

Aberle et al. (1968) state three basic forms of incest regulation: inhibition, prevention and prohibition. These forms may occur simultaneously and are not mutually exclusive. In certain cases there may be inhibition without prevention or prohibition, or vice-versa (Agren, 1984; Dewsbury, 1982; van den Berghe, 1983; Wolf, 1966).

Inhibition is best characterized by the ‘Westermarck effect’, which posits that there was an instinctive horror in nature for siblings reared together, that is, there is in nature incest avoidance for siblings reared together (Westermarck, 1891). van den Berghe (1983) uses the ‘Westermarck effect’ to explain the sexual aversion between siblings by means of a ‘negative sexual imprinting’ during a critical developmental age; and Demarest (1983) proposes that sexual indifference is due to a neurological habituation to peer sexual stimuli. Inhibition, thus, requires familiarity. Incest avoidance is built upon a socialization process that produces a biological reaction of sexual stimuli ‘numbness’, that is, siblings or even non-siblings, as shown by Agren (1984) and Dewsbury (1982), reared together until the ‘critical age’ will show signs of sexual aversion.

So individuals reared together will most likely never mate willingly.

Prevention is, as the name suggests, preventing kin from mating with each other. Rodrigues de Areia (1980), Deppute (1987) and Bixler (1981b) show how some non-human primates’ social organization, the *Gorilla gorilla*’s harem and the patrilineal groups of *Pan troglodytes* and *P. paniscus*, are adapted to expel specific kin members from their groups. In another work, Rodrigues de Areia (1989) relates these primates’ social organization to Tylor’s premise of ‘either marry out or be killed out’. Exogamy prevents incest and creates larger kin relations. This mechanism of prevention, exogamy, is what allows for human communities to emerge (Levi-Strauss, 1956).

Now we have communities emerging through a prevention mechanism. Exogamy could be argued to be a prevention mechanism, or an adaptation

to sexual avoidance of siblings. Given the complex nature of human social behavior, the sexual avoidance between siblings may have shaped the exogamic strategy followed by early groups. Exogamy is not mandatory, but it seems preferable to endogamy.

Prohibition is what many authors (Freud, 1953; Levi-Strauss, 1947; Malinowski, 1927; Seligman, 1950) argue as the difference between Human and animal and as the beginning of human society (Parker, 1976). Prohibition is, simply put, the cultural and social prohibition of incest. It is this difference from simple prevention into cultural and social norm, a very strict norm, that the referred authors separate Man from animal. Through the prohibition of incest, exogamy becomes mandatory and all the different kinship structures, together with the first large communities, emerge depending on the adaptive environmental needs (Parker, 1976).

So, the universality of the cultural incest taboo appears first in evolution as incest avoidance. As the groups get larger, social organization is conditioned by the preference of mating non-siblings or individuals who were not reared together. The adaptive and survival capacity of “intragroup cooperation and alliances in hunting and food distribution” (Parker, 1976) contributes to another increase in the size of the familial groups. Soon enough, the first kinship structures emerge and incest is prohibited to enforce exogamy, thus enforcing cooperation and alliances (*ibid.*). Margaret Mead’s work among the Arapesh illustrates how cooperation and alliances are so important to communal life:

“Don’t you understand that, if you marry another man’s sister, and another man marries your sister, you will have at least two brothers-in-law, and if you marry your own sister you will not have any? Who will you marry with? Who will you do crops with? Who would you visit?” (Mead *in* Héritier, 1989)

Hence, what started as a ‘numbness’ to peer sexual stimuli developed, over millions of years of biological and social evolution, into the kinship structures found nowadays among animal and human groups. What had a biological structure evolved through social and cultural meaning (Sahtouris, 1989)! Parker (1976) better clarifies this increase in the social and cultural meaning of incest taboo from “biological propensities of an organism” (*ibid.*):

“The incest *taboo* is (by definition) a cultural phenomenon and can be explained by cultural events. But like other sociocultural aspects it is “built upon” biopsychological needs, potentials, and propensities of the organism. (...) Incest avoidance was certainly not a sufficient condition for explaining the incest taboo, and it may not even have been a necessary condition – it was, however, a facilitating condition. The incest taboo constitutes learned behaviour, and as such is subject to principles of learning as is any other cultural item. However, insofar as it is motivated partly by biological propensities of the organism, it is easier to learn because it is subject to additional (aside from cultural) reinforcements from intraorganismic sources.” (Parker, 1976)

Hopefully, all the information poured above will help clarify the determinism of human behavior. It has been shown that biological propensities evolved throughout social and cultural processes, adapting humans and their interactions among themselves and to the particular environments in which they progressed through time. The particular case of incest is an example of the evolution of behavior, among many others, that is culturally and socially significant for researchers to track it back to its biological origin.

Another example that can be used is the male preference for females with a hip/waist ratio of 0.7 (Cartwright, 2000). The female is considered more attractive, regardless of her weight, if her hip/waist ratio is proximate to this particular value, which is correlated to the visual perception of higher female fertility. This does not mean, however, that every male will be attracted only to females with that specific value, but their perceptive system does certainly influence their mating preference. Analysis on beauty contests' results over the years shows that even though the weight may vary among winners, their relative hip/waist ratio remains fairly similar around 0.7 (Cartwright, 2000).

Behavior is a complex system. All that can be studied are single variables over millions of others. Then again, as it was said in Part I, a system will interact at its own level, that is, the incest taboo is in itself a complex system, it is, after all, a social and cultural production; but it can be easily related to human individual behavior due to its social and cultural meaning, which is how individuals interact with other individuals and communities at large.

**Part III**

Life has evolved over chemical reactions in a circumscribed structure, the cell. Every living organism is composed by cells (or cell) (Schrodinger, 1989). These chemical reactions follow the same physical laws described in Part I, and are, therefore, determined by them. Until the appearance of consciousness, life followed those simple rules. Upon the emergence of social behavior and, later on, self-awareness, these rules and corresponding structures have been replaced by their abstract thought counterparts. Ideas took the place of chemical substances and social interaction became the chemical reaction. The previous chemical reactions still remain part of what affects behavior, but its larger contributor is now social interaction.

Sociology, psychology and anthropology, amongst others, are fields of science that always tried to explain human behavior, but not a single one of them can absolutely determine the behavior of a single individual, only probable behaviors of large groups and its members within specific contexts. It is all a statistical and probabilistic approximation to behavior that is most of the times either culturally or politically biased (Bolin and Stanford, 1999; Button, 1999; Crewe and Harrison, 1998). Studies among these disciplines, especially among sociology, try to explain human behavior through analysis of group behavior. Psychology's use of individual qualitative data presents closer results to actual individual behavior than sociology, although many times obtained from group behavior observation, but they are still imprecise results. Anthropology's insight into individual and group evolutionary behavior of primates and humans researches a larger background on behavior to its evolutionary origins.

This is not an argument in favor of anthropology, but rather a favorable position towards the use of interdisciplinary knowledge on human behavior. An individual has its own personal biological constraints, but its behavior is the result of interaction with other individuals within a specific group, social and cultural context. Group behavior cannot be solely determined by the analysis of individual behavior (Ball, 2004), but there are certain characteristics of individuals that help shape group behavior (group leaders' individual behavior for instance).

Research on criminal behavior and its methods (LeBeau, 1987; LeBeau, 1992; LeBeau and Harries, 2007) show the accessory use of geographical profiling in offenders behavioral analysis. In other words, methodologies

developed on circumscribed disciplines present faulty assumptions on individual and specific behavior.

It becomes, then, important to understand how behavior developed throughout evolution to better comprehend how it interacts nowadays. The key element here is interaction (Ball, 2004). As it has been demonstrated in Part I, behavior interactions between individuals cannot be fully determined due to the complex nature of behavior itself. The probabilistic approach of individual behavior by the study of group behavior only becomes relevant due to the evolution and adaptation of the human mind towards favorable structures of communities (Ball, 2004; Cartwright, 2000; Cosmides and Tooby, 1992). It also shows what has been said above, complex systems interact at their own and approximate levels. A single individual, therefore, can only be fully comprehended on the research of his/her particular previous experiences and specific biological framework. Thus, it remains important the analysis of complex systems' at an approximate level of a single individual (group behavior analysis).

## **Conclusion**

Behavior follows a determinist structure, both biologically and socially. On a larger temporal scale, every individual's actions are accounted for and even briefly foreseen. Every event represents a 'bottle-neck' event towards other events. These are all very determined events on a universal scale. However, inability to globally assess individual forces resulted in an interpretation of 'free will', which, in turn, is explained as the cause of unpredictable behavior. Other interpretation could be that the narrow and locally circumscribed human perspective reflects upon a regional level only. This narrow human perception is merely an adaptation towards better chances of survival (Cartwright, 2000; Moran, 2006).

If human behavior is seen as a determinist complex system that follows the laws of physics, the simpler it becomes to perceive the required multidisciplinary approach to behavior. It is purely determinist, however unpredictable, on its complex nature. 'Randomness' or 'chaos' in behavior is merely the 'illusion of free will' and a possible sign of its humongous underlying structure that only a multidisciplinary approach (anthropology, psychology, sociology, biology, etc.) may be able to clearly, or at least more effectively, define it.

## Bibliography

- Aberle *et al.*, 1968. The incest taboo and the mating patterns of animals. *In*: Bohannan, P. and Middleton J., (ed.) *Marriage, Family and Residence*. New York, The National History Press: 3-19.
- Adler, F.; Mueller, G.; Laufer, W. 1991. *Criminology*. New York, McGraw-Hill.
- Ågren, G. 1984. Incest avoidance and bonding between siblings in gerbils. *Behavioral Ecology*, 3: 161-169.
- Alland, A. 1973. *Evolution and human behavior: an introduction to Darwinian anthropology*. New York, Anchor Press.
- Areia, M. L. Rodrigues de 1989. *Casamentos exogâmicos: aspectos biológicos e culturais*. Coimbra, Departamento de Antropologia/UC. 14p.
- Areia, M. L. Rodrigues de 1980. *Biological mechanisms for the prevention of incest among primates*. Coimbra, Instituto de Antropologia, 11p.
- Ball, P. 2004. *Critical mass: how one thing leads to another*. New York, Farrar, Straus and Giroux.
- Barash; Waterhouse. 1981. Comments (to Bixler, 1981a). *Current Anthropology*, 22(6): 643-644.
- Bixler, R. H. 1981a. Incest avoidance as a function of environment and heredity. *Current anthropology*, 22(6): 639-654.
- Bixler, R. H. 1981b. Primate mother-son "incest". *Psychological reports*, 48: 531-536.
- Bolin, R.; Stanford L. 1999. Constructing vulnerability in the First World: the Northridge earthquake in southern California, 1994. *In*: Hoffman, S. M.; Oliver-Smith, A. (eds.) *The angry Earth: disaster in anthropological perspective*. New York, Routledge: 89-112.
- Braidwood, R. J. 1952. *The Near East and the foundations for civilization*. Eugene, Oregon State System of Higher Education.
- Breuer, G. 1982. *Sociobiology and the human dimension*. Cambridge, Cambridge University Press.
- Button, G. V. 1999. The negation of disaster: the media response to oil spills in Great Britain. *In*: Hoffman S. M.; Oliver-Smith, A. (eds.) *The angry Earth: disaster in anthropological perspective*. New York, Routledge: 113-132
- Cartwright, J. 2000. *Evolution and human behavior: Darwinian perspectives on human nature*. Cambridge, The MIT Press.

- Cosmides, L.; Tooby, J. 1992. Cognitive adaptations for social exchange. In: Barkow, J.; Cosmides, L.; Tooby, J. (eds.) *The adapted mind: evolutionary psychology and the generation of culture*. New York, Oxford University Press.
- Crewe, E.; Harrison, E. 1998. *Whose development?: an ethnography of aid*. New York, Zed Books.
- Demarest, W. J. 1983. Comments (to van den Berghe, 1983). *Behavioral & Brain Sciences*, 6, March 1983.
- Deputte, B. 1987. L'évitement de l'inceste chez les primates. *La Recherche*, 18(193): 1332-1342.
- Dewsbury, D. A. 1982. Avoidance of incestuous breeding between siblings in two species of *Peromyscus* mice. *Biology of behaviour*, 7(2): 157-169.
- Dobzhanski, T. 1973. Nothing in biology makes sense except in the light of evolution. *The American Biology Teacher*, 35: 125-129.
- Evans-Pritchard, E. E. 1940. *The Nuer: a description of modes of livelihood and political institutions of a nilotic people*. Oxford, Clarendon Press.
- Frankfort, H. 1956. *The birth of civilization in the Near East*. New York, Doubleday Anchor Books.
- Freud, S. 1953. *Totem and Taboo*. Buenos Aires, Santiago Rueda.
- Gleick, J. 1987. *Chaos: making a new science*. New York, Penguin Books.
- Graburn, N. 2000. What is tradition? *Museum Anthropology*, Winter 2000/Spring 2001, 2-3: 6-11.
- Gribbin, J. 2004. *Deep simplicity: bringing order to chaos and complexity*. New York, Random House.
- Hawking, S. 1988. *A brief history of time*. New York, Bantam Books.
- Harris, M. 1974. *Cows, pigs, wars & witches: the riddles of culture*. New York, Random House.
- Héritier, F. 1989. Incesto. In: Enciclopédia Einaudi – *Parentesco*. Lisboa: Imprensa Nacional – Casa da Moeda, 20: 95-124.
- Karam, A. M. 2000. Islamism and the decivilising processes of globalization. In: Arce, A.; Long, N. (eds.) *Anthropology, development and modernities: exploring discourses, counter-tendencies, and violence*. New York, Routledge: 64-73.
- LeBeau, J. 1987. Patterns of stranger and serial rape offending: factors distinguishing apprehended and at large offenders. *The Journal of Criminal Law & Criminology*, 78(2): 309-326.
- LeBeau, J. 1992. Four case studies illustrating the spatial-temporal analysis of serial rapists. *Policing: an International Journal of Police Strategies & Management*, 15:124-145.

- LeBeau, J.; Harries, K. 2007. Issues in the geographic profiling of crime: review and commentary. *Police Practice and Research*, 8(4): 321-333.
- Lévi-Strauss, C. 1947. *Les structures élémentaires de la parenté*. Paris, Presses Universitaires de France.
- Lévi-Strauss, C. 1956. The family. In: Shapiro, H. L. (ed.) *Man, culture and society*. New York, Oxford University Press.
- Malinowski, B. 1927. *Sex and repression in savage society*. Londres, Routledge.
- Moran, E. F. 2006. *People and nature: an introduction to human ecological relations*. Malden, Blackwell Publishing.
- Murdock, G. P. 1969. *Social Structure*. Nova Iorque, MacMillan.
- Parker, S. 1976. The precultural basis of the incest taboo: toward a biosocial theory. *American Anthropology*, 78(2): 285-305.
- Pratt, M. L. 1992. *Imperial Eyes: travel writing and transculturation*. London, Routledge.
- Prigogine, I.; Stengers, I. 1984. *Order out of chaos: man's new dialogue with nature*. New York, Bantam Books.
- Prigogine, I. 1980. *From being to becoming: time and complexity in the physical sciences*. New York, W H. Freeman and Company.
- Sahlins, M. 1976. *The use and abuse of biology: an anthropological critique of sociobiology*. Ann Arbor, The University of Michigan Press.
- Sahtouris, E. 1989. *Gaia: the human journey from chaos to cosmos*. New York, Pocket Books.
- Seligman, B. Z. 1950. The problem of incest and exogamy: a restatement. *American Anthropologist*, 52(3): 305-316.
- Schrodinger, E. 1989. *What is life?: with "Mind and matter" and "autobiographical sketches"*. Cambridge, Cambridge University Press.
- Teixeira, V. 2006. *Da aversão sexual à formação de grupos familiares e ao interdito do incesto*. Departamento de Antropologia, Universidade de Coimbra. Unpublished article.
- van den Berghe, P. L. 1983. Human inbreeding avoidance: culture in nature. *Behavioral & Brain Sciences*, 6: 91-123.
- Welch, P. 2008. Personal communication.
- Westermarck, E. 1891. *The history of human marriage*. London, MacMillan.
- Wolf, A. P. 1966. Childhood association, sexual attraction, and the incest taboo: a Chinese case. *American Anthropologist*, 68(4): 883-898.

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