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# **ETHOLOGICAL PERSPECTIVE ON THE STUDY OF BULLYING**

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*The animals themselves are always more important than the books that have been written about them.*

Niko Tinbergen, 1953  
(as cited in McGrew, 2004)

*(...) we animals are the most complicated and perfectly designed pieces of machinery in the known universe (...) it is hard to see why anyone studies anything else.*

Richard Dawkins, 1989  
(as cited in Barnard, 2004)



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# ABSTRACT

Bullying is a phenomenon extremely pervasive throughout the lives of all its participants. It represents a form of pro-active aggressive behavior occurring in contexts of power imbalances and frequently being a repeated experience. Bullying is ubiquitous, with its worldwide prevalence of victimization lying mainly over the 20% mark and almost reaching the 40% mark in Portugal. Its deleterious outcomes range from low academic achievement and some somatizations, to severe depression, suicides and homicides, hence the extreme medico-legal pertinence in understanding and preventing it. So far, the majority of the studies regarding bullying behaviors have resorted to indirect measures such as surveys and questionnaires, and only few have employed ethological methods and concepts to their design.

The main objective of the present work was to approach bullying through an ethological standpoint in an attempt to gain a more comprehensive insight into this problematic. More specifically, we aimed to, resorting to naturalistic observations, identify a dominance hierarchy within a group of adolescents in school and to analyze a possible relation between rank order and engaging in bullying behaviors.

Resorting to a sample of 6 male adolescents, rank orders were assessed and dominance indices were calculated for each subject. A focal instantaneous sampling was employed to measure both the frequencies and the durations of dominance-related behaviors. The sampling points took place every 30 sec, making a total of 2,5 minutes of sampling period per subject, within a 15-minute observation. A focal-only sampling was used as well in order to record, per subject, every behavior occurring in a bullying context.

The results of this study revealed a rank ordering among the sample, with the top ranking element engaging significantly more in non-aggressive/non-intentionally aggressive dominance behaviors than the other hierarchical categories; the bottom rank subject displaying significantly more submissive behaviors; and with the individual occupying the second dominant position in the hierarchy exhibiting statistically significantly more aggressive behaviors in bullying contexts than the other categories of dominance, with the exception of the most dominant element.

Together, these results support the hypothesis that engaging in bullying behaviors may be an antisocial, aggressive attempt to achieve dominance within a group. However, further studies at a larger scale and resorting to other methods (such as audiovisual recordings) should be conducted in order to increase the statistical power of the results of this study.

## **Keywords**

Bullying; Ethology; Naturalistic observations; Aggression; Dominance; Submission; Hierarchy

## **Abbreviations**

CD – counter dominance

GSHS – Global school-based student health survey

H<sub>0</sub> – null hypothesis

H<sub>a</sub> – alternative hypothesis

HBSC - Health Behaviour in School-aged Children

obs – observation

OOS – out-of-sight

PA – physical attack

POD – physical/object displacement

RG – recognition

SB – submission

sec – seconds

SD – subtle dominance

TR – threat

UNICEF – United Nations Children’s Fund

VA – verbal attack

# RESUMO

O *bullying* é um fenómeno extremamente intrusivo nas vidas de todos os seus participantes. Apresenta-se como uma forma de agressão pró-ativa que ocorre em contextos de desequilíbrio de poder e, na sua maioria, de forma repetida. Para além de ubíquo, o *bullying* exhibe uma prevalência considerável, com os valores de vitimização a nível mundial localizados maioritariamente acima dos 20% e alcançando quase os 40% em Portugal. Os seus efeitos deletérios variam desde baixo desempenho académico e algumas somatizações, a depressão grave, suicídios e homicídios, daí a extrema pertinência médico-legal na compreensão e prevenção deste fenómeno. Até à data, a maioria dos estudos sobre comportamentos de *bullying* tem recorrido a medidas indiretas, como inquéritos e questionários, sendo que poucos empregaram métodos etológicos no seu desenho.

O principal objetivo do presente trabalho foi a abordagem ao *bullying* através de uma perspetiva etológica numa tentativa de obter uma visão mais abrangente sobre esta problemática. Mais especificamente, teve como objetivo, recorrendo a observações naturalistas, a identificação de uma hierarquia de dominância dentro de um grupo de adolescentes em contexto escolar e a análise de uma possível relação entre uma ordenação hierárquica e o envolvimento em comportamentos de *bullying*.

Recorrendo a uma amostra de seis adolescentes do sexo masculino, foram avaliadas as ordens de classificação hierárquica e calculados os índices de dominância para cada sujeito de estudo. Uma amostragem instantânea focal foi empregue para medir tanto as frequências como as durações de comportamentos relacionados com dominância. Os pontos de amostragem ocorreram a cada 30seg, perfazendo 2,5 minutos de período de amostragem por indivíduo, num total de 15 minutos de observação. Uma amostragem apenas focal foi utilizada para registar, por sujeito, cada comportamento ocorrido em contexto de *bullying*.

Os resultados deste estudo revelaram a existência de uma ordem hierárquica entre a amostra, com o elemento do topo do ranking significativamente mais envolvido em comportamentos de dominância não agressivos ou não intencionalmente agressivos do que as outras categorias hierárquicas; com o membro que ocupa o último lugar na hierarquia a exhibir significativamente mais comportamentos submissos; e com o indivíduo relativo à segunda posição na hierarquia mostrando-se estatisticamente mais agressivo e perpetrando mais comportamentos de *bullying* quando comparado com todas as outras categorias de dominância, com exceção do elemento mais dominante.

Em conjunto, estes resultados apoiam a hipótese de que o envolvimento em comportamentos de *bullying* pode consistir numa tentativa antissocial e agressiva para alcançar uma posição de dominância dentro de um grupo. No entanto, devem ser realizados estudos adicionais, a uma escala maior e recorrendo a outros métodos (tais como gravações audiovisuais), a fim de aumentar o poder estatístico dos resultados deste estudo.

## **Palavras-chave**

*Bullying*; Etologia; Observações naturalistas; Agressão; Dominância; Submissão; Hierarquia

## **Abreviaturas**

CD – contra dominância; counter dominance

GSHS – Global school-based student health survey

H<sub>0</sub> – hipótese nula

H<sub>a</sub> – hipótese alternativa

HBSC - Health Behaviour in School-aged Children

obs – observação; observation

OOS – fora do campo de visão; out-of-sight

PA – ataque físico; physical attack

POD – remoção de posição e/ou objeto; physical/object displacement

RG – reconhecimento; recognition

SB – submissão; submission

sec – segundos; seconds

SD – dominância subtil; subtle dominance

TR – ameaça; threat

UNICEF – Fundo das Nações Unidas para a Infância; United Nations Children's Fund

VA – ataque verbal; verbal attack

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# INTRODUCTION

## 1. Ethology, the science of behavior

### 1.1. What is ethology and why study animal behavior?

Ethology is a sub-discipline of Biology concerned with the study of animal behavior within its natural settings; that is, without artificial variation of environmental parameters and disturbance to the subjects (Moreno & Muñoz-Delgado, 2007; Rajecki, 1983; Vieira, 1989).

Throughout the years, several meanings were given to the term and numerous intellectuals devoted their time to the study of various aspects of behavior, from Aristotle in Ancient Greece to Charles Darwin, in the late 19<sup>th</sup> century (Moreno & Muñoz-Delgado, 2007). Nevertheless, the actual scientific significance attributed to Ethology is due to the works of Konrad Lorenz, Nikolas Tinbergen and Karl von Frisch, who studied the behavior of various animal species in their natural environment and who shared, because of that, the Nobel Prize in Medicine and Physiology in 1973 (Barnard, 2004; Moreno & Muñoz-Delgado, 2007).

Lorenz (1960a, as cited in Lehner, 1996, p. 2) outlined Ethology “as the application of orthodox biological methods to the problems of behavior”; whereas Tinbergen (1963, p. 411) described it as “the biological study of behavior”, guided by the “biological method” and in which the “description of observable phenomena” plays a vital role.

Thus, the term Ethology may be defined as the “scientific study of animal behavior” (Dugatkin, 2014, p. 26) characterized by the Ethological method (that is, with a great emphasis on naturalistic observations) (Rajecki, 1983); a definition widely accepted by the behavioral research community (e.g., Calafate (1996), Barnard (2004), Savin-Williams (1987), among others).

This perception of Ethology implies that the behavior presented by any living organism reflects the biological program of its species, which means that it represents a phenotypic trait as much as anatomical or physiological ones (Cosnier, 1986; Jones, 1972; Michel & Moore, 1995). One must not forget, however, that any “individual exists in time and space in a dynamic state, continually under the influence of its environment, continually imposing its own effects upon the environment” (Lehner, 1996, p. 152). For that reason, behavior, as any other trait, is dependent on the relations established between the organism that displays it and its surroundings. Hence, Calafate (1996) emphasizes its importance and outlines the object of Ethology as the spontaneous behavior exhibited by an individual in its natural background. Moreover, since the functional and adaptive significance of any behavior is

only acquired in its natural settings, to fully understand an organism, one must study it in its regular contexts (Tinbergen, 1963; Vieira, 1989).

In fact, humans have always been reliant on naturalistic observations of animal behavior in order to assure their survival (Alcock, 2001; Dugatkin, 2014). For instance, our hunter-gatherer ancestors had to understand the behavior of both their preys and their predators, otherwise, “we humans wouldn’t be here today” (Dugatkin, 2014, p. 4).

In 1992, Drickamer and Vessey (as cited in Lehner, 1996, p. 2) listed seven present-day reasons to study animal behavior: “1) Curiosity about the living world; 2) Learn about relationships between animals and their environments; 3) Establish general principles common to all behavior; 4) Better understand our own behavior; 5) Desire to preserve and maintain the environment; 6) Conserve and protect endangered species; 7) Control economically costly animal pests”.

Thereby, Ethology must be considered in an interdisciplinary manner, somewhere between the Natural and Human sciences, because it interacts with a number of other disciplines such as Physiology, Genetics, Ecology, Sociobiology, Comparative Psychology, Taxonomy, Molecular Biology, Paleontology, Anthropology, among others, without losing its own identity (Vieira, 1989).

### **1.1.1. Definition of behavior**

The basis to any scientific study is the definition and clarification of its underlying concepts. Ethology, deriving from Biology, is no exception. For that reason, the concept of behavior must be defined in a careful, clear and concise way.

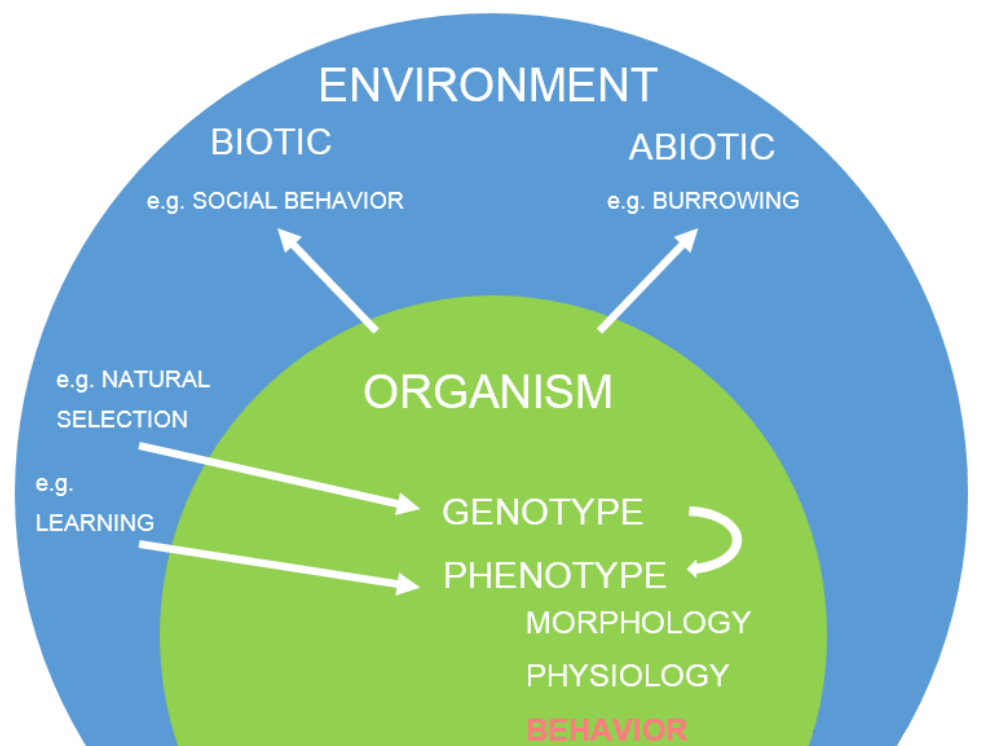
The definition proposed by Tinbergen (as cited in Dugatkin, 2014, p. 6) portrays behavior as “the total movements made by the intact animal”, a description that integrates virtually the totality of an animal’s actions. However, not all actions can be considered behavior. Levitis et al. (2009, as cited in Dugatkin, 2014) provide a simple but understandable example: an increase in body temperature leads to sweating in response but sweating is not considered a behavior by itself. Conversely, if an animal seeks shade because of the heat (and its subsequent perspiration), that action can be considered a behavior.

The same authors elaborated a paper where they reviewed what constitutes behavior to 174 behavioral researchers. The results showed the lack of a universally accepted definition, varying from Raven and Johnson’s “What an animal does” in 1989 to “All observable or otherwise measurable muscular and secretory responses (or lack thereof in some cases) and related phenomena such as changes in blood flow and surface pigments in response

to changes in an animal's internal and external environment", proposed by Grier and Burk, in 1992. (Levitis et al., 2009, as cited in Dugatkin, 2014, p. 7).

Hence, Dugatkin (2014, p. 7) proposed defining behavior as "the coordinated responses of whole living organisms to internal and/or external stimuli", a definition that stresses the distinction between organ and organism. Employing the aforementioned example, sweating due to increased body temperature is an organ-level response whilst moving to shade because of the heat and perspiration represents a coordination of responses at an organism-level (Dugatkin, 2014). And as Barnard (2004, p. 284) stated, "ultimately all behavior develops through a combination of genetic and environmental influences", the internal and external stimuli proposed by Dugatkin, respectively.

Figure 1 schematically represents the complex relationship established between an organism and its surrounding environment. Behavior is dependent on the morphology and physiology of the organism, which are products of gene expression (Barnard, 2004; Lehner, 1996). In turn, the environment may directly modify the morphology of the organism by means of injury and disease and affect the biochemical setting needed for gene expression by variations in temperature, light and humidity, in addition of being the bearer of selective pressures for natural selection (Alcock, 2001; Barnard, 2004; Lehner, 1996). That is, the environment may confer flexibility to the behavior of an organism by, for instance, emitting signals responsible for triggering alternative developmental pathways (Alcock, 2001).



**Figure 1.** Schematic diagram representing organism-environment relationships. Arrows indicate the direction of the interaction. *Adapted from Lehner (1996, p. 152)*

Thus, the environment has the ability to both enable and restrain behavior, by means of its biotic and abiotic components. Innate behaviors and predispositions, as well as learned and cultured transmitted ones, are only properly developed and expressed if the environment is suitable for that (Alcock, 2001; Lehner, 1996). On the other hand, the organism also exerts influence on “both the biotic environment (e.g. intra- and interspecific social behavior) and the abiotic environment (e.g. a badger burrowing into a hillside)” (Lehner, 1996, p. 153).

### **1.1.2. The Ethological method - why study bullying through an ethological perspective?**

On his paper, *On aims and methods of Ethology*, Tinbergen (1963) delineated what can be considered the ethological method.

As previously said, and since “the science is characterized by an observable phenomenon” (Tinbergen, 1963, p. 411) (i.e. behavior), Ethology stresses the importance of naturalistic observations and greatly relies on the description of naturally occurring events. It also follows the biological approach, which is modelled by the scientific method and guided by four major problems in Biology: that of mechanism or causation, that of ontogeny or development, that of function or survival value, and that of phylogeny or evolution (Tinbergen, 1963). These four types of questions intend to specifically answer the vague question posed by Tinbergen (1963, p. 411) “Why do these animals behave as they do?” at four distinctive yet complementary levels.

The *mechanism* of behavior refers to its immediate causation, to the mechanisms, contexts and stimuli (internal/external) underlying it (Barnard, 2004; Dugatkin, 2014; Jones, 1972; Lehner, 1996); that is, to the “preceding events which can be shown to contribute to the occurrence of the behavior” (Tinbergen, 1963, p. 418). *Ontogeny* focuses on how the maturation of an organism affects the development of the behavior (Barnard, 2004; Calafate, 1996; Dugatkin, 2014; Jones, 1972; Lehner, 1996); on the “change of behavior machinery during development” (Tinbergen, 1963, p. 424). The *function* of the behavior is related to its role in the life of an organism, and to if and how it affects its survival and reproduction; in other words, relates to the survival value of behavior (Barnard, 2004; Dugatkin, 2014; Jones, 1972; Tinbergen, 1963). The study of the *phylogeny* in Ethology is based on the premise that behavior, as a phenotypic trait, is also subject of natural selection (Vieira, 1989). In fact, as Theodosius Dobzhansky (1964, p. 449) once stated, “nothing makes sense in biology except in the light of evolution”. Employing a phylogenetic comparative approach by studying behavior in closely related species allows the clarification of how behavior has been shaped in the course of evolution and the unravelling of its underlying forces, such as selective pressures and phylogenetic constraints (Barnard,

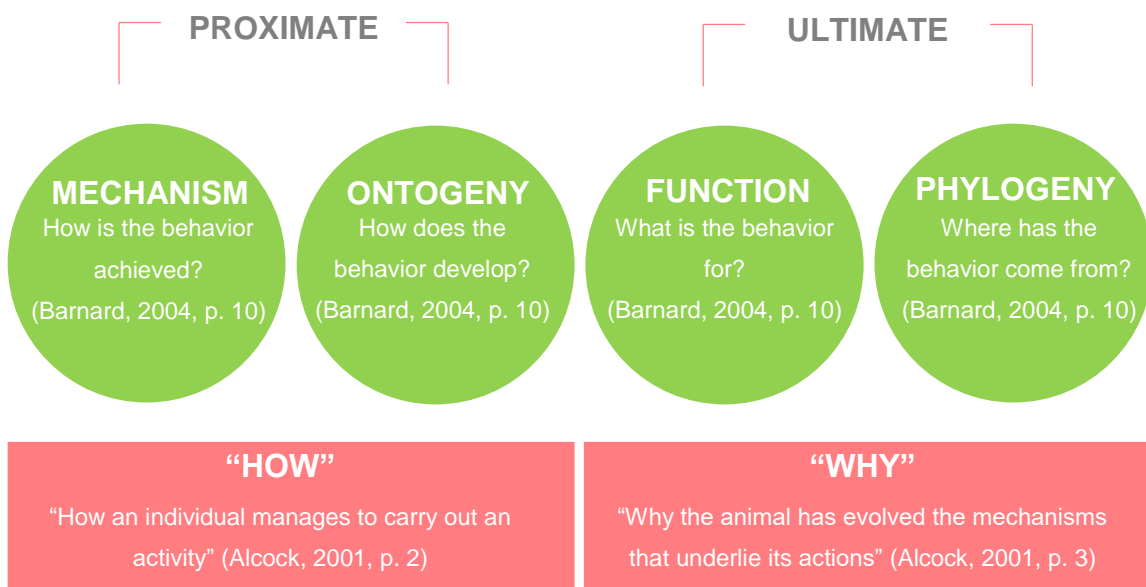
2004; Calafate, 1996; Dugatkin, 2014; Jones, 1972; Lehner, 1996; Michel & Moore, 1995; Tinbergen, 1963).

However, these four types of questions can be allocated into two broader categories: proximate or ultimate causes (Alcock, 2001; Barnard, 2004; Dugatkin, 2014; Lehner, 1996).

The proximate causes comprise those questions about the mechanism and ontogeny of behavior (Alcock, 2001; Barnard, 2004; Dugatkin, 2014; Lehner, 1996), also entitled as “how questions” (Alcock, 2001, p. 2), which are related to how a behavior is performed and to what makes it possible (Alcock, 2001; Barnard, 2004). Conversely, the ultimate causes of behavior comprehend the questions about the function and phylogeny of behavior (Alcock, 2001; Barnard, 2004; Dugatkin, 2014; Lehner, 1996); that is, questions related to its adaptive significance and evolutionary mechanisms (Alcock, 2001; Barnard, 2004), or “why questions” (Alcock, 2001, p. 2).

Proximate and ultimate questions also complement each other, both being required for the complete understanding of any behavior (Alcock, 2001; Dugatkin, 2014).

All these types of questions, as well as the way they are related to each other, are represented in Figure 2.



**Figure 2.** Schematic representation of the relation of Tinbergen's four questions to the analysis of proximate and ultimate causation. *Adapted from Lehner (1996, p. 8).*

## 1.2. Human ethology

The animal nature of human beings is something unquestionable (Gallup & Suarez, 1983; Jones, 1972). Its uniqueness is also a fact; however, every other species is unique in its

particular way (Alcock, 2001; Jones, 1972). Furthermore, many of the phenomena associated to the uniqueness of *Homo sapiens* such as culture, religion, tool fabrication and use, language, reason and self-awareness, can also be found among other species (see Appendix A), suggesting that these inter-specific differences might “be a matter of degree rather than of kind” (Gallup & Suarez, 1983, p. 11). Ultimately, Man is a “biological phenomenon” (Gallup & Suarez, 1983, p. 5), a living organism under the influence of the same physiological determinants and subject to natural selection as any other animal (Alcock, 2001; Gallup & Suarez, 1983). Therefore, a much more comprehensive understanding of human behavior can be achieved if an ethological approach is employed.

Human ethology, defined as the biology of human behavior and characterized by the application of ethological concepts and methods to its study, is a discipline that puts the accent on the observation and description of the conduct of *Homo sapiens* in its natural environment in an attempt to understand and clarify it (Calafate, 1996; Cosnier, 1986; Klein, 2000; Moreno & Muñoz-Delgado, 2007; Savin-Williams, 1987).

Human behavior not only is shaped by selective pressures of natural selection but also is strongly influenced by different cultural environments (Alcock, 2001; Barnard, 2004; Fox & Fleising, 1976; Savin-Williams, 1987). It is essential, however, to recognize that humans don't act only “biologically” or “culturally”. Most of the time, Man “behaves in a predictable way” (Eibl-Eibesfeldt, 1977, p. 163), which means that its conduct is, at least partly, predetermined by evolution (Barnard, 2004; Eibl-Eibesfeldt, 1977; Savin-Williams, 1987). Nevertheless, evolutionary theory only acknowledges the tendency of certain natural selected traits to promote inclusive fitness of its bearers (Alcock, 2001), thus not being a synonym for “biological determinism” (Eibl-Eibesfeldt, 1977, p. 167). If, on the one hand, some traits preserved in time may not remain as adaptive as they once were, on the other hand, the cultural component of human behavior makes it somewhat malleable, allowing humans to control their conducts, even the innate ones (Alcock, 2001; Eibl-Eibesfeldt, 1977).

Therefore, Human Ethology, guided by the synthetic theory of evolution (Fox & Fleising, 1976), employs ethological methods in order to “explain, not justify” (Alcock, 2001, p. 486) human behavior. It also acknowledges the existence, not of a “primate pattern” (Savin-Williams, 1987, p. 25), but rather of a “common heritage” (Eibl-Eibesfeldt, 1977, p. 180) in behavior among closely related species. Hence, “cross-species research” (Savin-Williams, 1987, p. 25) provides the theoretical basis for understanding human behavior (Alcock, 2001; Eibl-Eibesfeldt, 1977; Savin-Williams, 1987), and may “reveal specific and ubiquitous characteristics of human development” (Michel & Moore, 1995, p. 415).

To date, the majority of behavioral studies concerning the human species have heavily relied on a traditional psychological approach that resorts to experimentation in “contrived, staged settings” (Savin-Williams, 1987, p. 9) and to auto- and hetero-reports (Atlas & Pepler, 1998; Barrett & Stulp, 2013; Berger, 2007; Michel & Moore, 1995; Savin-Williams, 1987; Zivin, 1983). The latter, considered indirect measures, can take the form of interviews, questionnaires and rating scales/checklists, among others (Jones, 1972; Michel & Moore, 1995; Pellegrini, 1998; McGrew, 1972, as cited in Rajecki, 1983, p. 79; Richards & Bernal, 1972). However, this methodology may prove to be disadvantageous if employed in an exclusive way in research of human behavior.

First, it focuses mainly on the individual (Savin-Williams, 1987; Vieira, 1989; Zivin, 1983) and attempts to “assess personality phenomena” (Savin-Williams, 1987, p. 190) through a trait model, i.e., by examining personality attributes that individuals may “have a certain amount of” (Zivin, 1983, p. 187). Consequently, and because human beings are not isolated entities, it tends to disregard the social context of behavior (Savin-Williams, 1987; Zivin, 1983).

Then, the results obtained by reports, regardless of the source, may not reflect the actual behavior under study (Michel & Moore, 1995). Indeed, many aspects are highly likely to affect the outcomes of these tests, namely the design of the research, the way a situation was perceived as well as the ability to report it and even cases of purposeful deception (Berger, 2007; Craig et al., 2000; Jones, 1972; Richards & Bernal, 1972; Smith et al., 1999). For instance, ambiguously defined concepts may lead to misinterpretation of the questions posed. Similarly, low age, cognitive impairment and self-conscious emotions (such as pride or shame) may diminish/alter the perception of certain events and, thus, the ability to report them. There can also be the case that the individuals submitted to the tests deliberately lead the researchers in the wrong direction. Consequently, the findings from this type of tests are somewhat limited since they reflect “only what people say and leave unanswered the question of what they actually do”, as stated by Barrett and Stulp (2013, p. 41).

Lastly, the laboratory study of behavior also presents some disadvantages. Since it requires carefully controlled conditions, this type of research provides high internal validity if the protocol is meticulously designed and followed (Pepler & Craig, 1995). However, and because the experimental settings are artificial, the behavior under analysis is not spontaneous but rather a reaction to the circumstances imposed by the researcher or even to the presence of the researcher itself and may not be representative of normative contexts (Cosnier, 1986; Pepler & Craig, 1995; Savin-Williams, 1987). Also, some natural occurring conditions are unethical to replicate thus being impossible to comprehensively study behavior (especially human) (Pepler & Craig, 1995). Both the reactivity displayed by the

participants and the ethical limitations imposed make drawing conclusions difficult and the generalization of the results flawed, lowering the external validity of this methodology (Barrett & Stulp, 2013; Pepler & Craig, 1995; Savin-Williams, 1987).

Therefore, and considering the emphasis placed by Ethology on the direct observation and description of naturally occurring behavior, a multi-method approach combining both the psychological and ethological methodologies may prove to be extremely advantageous when investigating the complex phenomena of human behavior (Archer, 1995; Barrett & Stulp, 2013; Berger, 2007; Cosnier, 1986; Lehner, 1996; Michel & Moore, 1995; Moreno & Muñoz-Delgado, 2007; Pellegrini, 1998; Pepler & Craig, 1995; Rajcecki, 1983; Savin-Williams, 1987). Thereby, the strengths of each method are enhanced as well as their weaknesses minimized.

In the end, Human Ethology is not about portraying Man as “nothing but another ape” (Eibl-Eibesfeldt, 1997, p. 21) but simply recognizing its natural history and applying ethological methods to the study of its behavior. After all, as stated by Washburn and Dolhinow (1983, p. 28), “If our goal is to understand human behavior, we must begin our study with human beings”.

## **2. School Bullying, a pervasive experience**

### **2.1. Characterization of the phenomenon**

Friendships, peer interactions and social life play an essential role in the lives of children of all ages. Adolescents turn to their peers more often than to their parents, and having friends has been shown to be an essential contribution to greater social competence, sense of well-being and self-esteem. Since it is where children spend most of their day at, school is where predominantly friendship bonds are established and groups are formed (UNICEF, 2014).

On the other hand, and because it's where most peer interactions occur, schools, as well as routes to and from it, are the most common scenarios for bullying episodes (Farrington & Ttofi, 2009; Lisboa et al., 2009; Ttofi & Farrington, 2011; UNICEF, 2014; Vreeman & Carroll, 2007). Within the school setting, bullying is more likely to take place in the playground because it's where there is the least amount of adult supervision (Atlas & Pepler, 1998; Craig et al., 2000; Pellegrini, 1998; Pereira et al., 2004; Rigby, 2002; Vreeman & Carroll, 2007).

Various research investigations showed that, despite variations in its prevalence, bullying is a ubiquitous phenomenon affecting a substantial proportion of children across countries,

cultures, socioeconomic status, age groups and gender (Berger, 2007; Book et al., 2012; García & Margallo, 2014; Lisboa et al., 2009; Volk et al., 2012). Furthermore, evidence of this phenomenon has been found in records from a number of historical civilizations (e.g. Greek, Roman), showing that bullying is also not exclusively linked to modern human societies (Book et al., 2012; Volk et al., 2012).

Even though it constitutes a very serious form of peer aggression and is one of the most common forms of school violence, the matter of bullying is still widely taken as a natural, character forming, part of growing up (Arseneault et al., 2010; Lisboa et al., 2009; Matos et al., 2009; Olweus, 2013; Smith & Brain, 2000; Wong & Schonlau, 2013). Notwithstanding these beliefs, bullying causes a great deal of suffering to the victims and is a violation of the child's rights (Aluede et al., 2008; United Nations).

Therefore, it becomes imperative to clarify the concepts inherent to the phenomenon and acknowledge that it is more than a child's play.

### **2.1.1. Definition**

When, around the late 1960's and early 1970's, research on bullying first began to emerge, it was acknowledged under the term "mobbing", alluding to the ethological concept of a "collective attack by a group of animals on an animal of another species, which is usually larger and a natural enemy of the group" (Olweus, 2013, p. 753). However, Dan Olweus, a Swedish academic and one of the pioneers in the study of bullying, raised some doubts concerning the suitability of the application of the term "mobbing" to this phenomenon and, as a result, he suggested designating it as bully/victim problems (i.e. bullying). This same researcher was also responsible for the currently most accepted definition of bullying. According to Olweus, bullying is a form of aggressive behavior that encompasses three defining features: intentionality, imbalance of power and (some) repetitiveness (Olweus, 2013).

The *intentionality* of the behavior implies a kind of proactive, deliberate and purposive aggression in which there is a clear desire/intent to cause fear, distress or harm, as opposed to reactive aggression (Lisboa et al., 2009; Olweus, 2013; Ttofi & Farrington, 2011). This means that bullying is unprovoked by the victim, which excludes such motives as retaliation, among others. In turn, the *power imbalance* feature entails a difference of strength between the participants that makes extremely difficult for the victim to defend him or herself. This asymmetrical power relationship can be real or perceived, ranging from actually being physically abler to hurt others or being numerically superior, to being more confident, assertive, socially competent and/or more popular. Lastly, the *repetitiveness* of the behaviors reflects the chronic character that most of bullying situations acquire. However,

Olweus (2013, p. 757) doesn't consider it as an "absolutely necessary criterion" but rather recognizes it as a means of demonstrating the intentional component inherent to the phenomenon. Furthermore, the events may be so strong and traumatizing that a single occurrence may be enough to bring about extremely deleterious consequences to the victim, similar to those resultant from continuous bullying (Atlas & Pepler, 1998; Costa & Pereira, 2010; Evans et al., 2014; Garandau & Cillessen, 2006; Lisboa et al., 2009; Olweus, 2013; Reijntjes et al., 2013; Rigby, 2002, 2003, 2004; Smith & Brain, 2000; Ttofi & Farrington, 2011; Weisfeld & Weisfeld, 2013).

Although the conjunction of the three features mentioned above is what qualifies certain behaviors as bullying, it's the power asymmetry that distinguishes it from other forms of aggression (Olweus, 2013). Therefore, it's not bullying when victimization occurs between people of the same strength (physical, psychological, verbal), when the use of forcefulness is justifiable (e.g. dentists and teachers in their practice, among others) or when children are playfully fighting/teasing each other (Dake et al., 2003; Rigby, 2003, 2004). However, and despite the imbalance of power being one of its defining characteristics, to be considered bullying it must occur between individuals of the same age group (children-children; adults-adults). When aggression is perpetrated by adults towards children, it's considered maltreatment rather than bullying (Arseneault et al., 2010).

In sum, and according to Ken Rigby (2002, p. 51), an Australian researcher also widely acknowledged in this field of investigation, "*Bullying involves a desire to hurt + hurtful action + a power imbalance + (typically) repetition + an unjust use of power + evident enjoyment by the aggressor and generally a sense of being oppressed on the part of the victim.*".

As Shaw et al. (2013) stated, providing a clear and succinct definition ensures the correct identification of bullying through the recognition of its three key elements, its distinction from other forms of aggression, as well as a more comprehensive and collective perception of the phenomenon.

### **2.1.2. Forms of bullying**

In general, bullying events can occur either directly or indirectly (Berger, 2007; Garandau & Cillessen, 2006). Furthermore, they can also fit into one (or more) of five specific categories: physical, verbal, gestural, relational and cyber (Olweus, 2013; Rigby, 2003).

*Direct* or, as children call it, "to my face" (Berger, 2007, p. 95) bullying involves the bully directly confronting the victim (Arseneault et al., 2010; Atlas & Pepler, 1998). On the other hand, *indirect* or "behind my back" (Berger, 2007, p. 95) bullying is characterized by the lack of direct conflict (Garandau & Cillessen, 2006). Because the presence of the bully is not

an absolute requirement, this type of hurtful actions are easier to occur, harder to detect and self-defense from the victim is nearly impossible since he/she does not know whom to blame (Arseneault et al., 2010; Berger, 2007). Thereby, direct forms of bullying are the most easily identifiable and entail a higher probability of being caught, punishment and retaliation. (Volk et al., 2012).

*Physical* bullying refers to aggressive physical behaviors directed at the victim and/or his/her property (Shaw et al., 2013). While direct physical bullying involves such behaviors as physical aggression (e.g. hitting and kicking, among others), extortion and weapon usage, indirect forms include bullies getting another person to assault the victim, as well as hiding or removing the victim's belongings (Berger, 2007; Matos & Gonçalves, 2009; Rigby, 2003).

*Verbal* forms of bullying use written or spoken language as a means to distress others (Doğruer & Yaratan, 2014; Evans et al., 2014). This type of bullying comprises, among others, actions like insults and threats (direct verbal bullying) or defamation and anonymous phone calls (indirect verbal bullying) (Rigby, 2003). Additionally, this kind of abuse is the most frequently reported and observed (Berger, 2007; Craig et al., 2000; Matos et al., 2009; Melim & Pereira, 2012).

*Gestural* bullying concerns the bully's facial or bodily posture. It can take the form of menacing, threatening and/or offensive gestures, signs and stares, either directly or behind the victim's back (Rigby, 2003).

*Relational* bullying behaviors aim at damaging someone's reputation and disrupting his/hers social relationships. These goals can be achieved either directly through ostracism and the formation of overt coalitions against the victim, or indirectly by manipulating the victim's social image before others (Rigby, 2003; Shaw et al., 2013).

With the advent of technology and the multiplicity of means of communication, new ways of perpetrating bullying emerged (Bauman et al., 2013). *Cyberbullying* consists in the use of technologies to hurt others (Hinduja & Patchin, 2010). In this form of bullying, bullies resort to emails, text messages, social networks, websites and blogs to threaten, offend, intimidate, defame, exclude, impersonate and/or humiliate someone (UNICEF, 2014). Due to the wide range of behaviors that it comprises, cyberbullying can overlap with other forms of bullying, namely verbal and relational. Additionally, it is also not possible to distinguish between direct and indirect means of cyberbullying because the identity of the bully remains unknown in the majority of the events.

Moreover, all forms of bullying abovementioned can encompass behaviors with sexual connotation and directed to the difference (e.g. racial/ethnic minorities and disability) (Lisboa et al., 2009; Olweus, 2013; Rigby, 2003; UNICEF, 2014; Volk et al., 2012).

Altogether, the bullying phenomenon has multiple distinct dimensions (see Figure 3) all of which can be perpetrated by the same bully (or group of bullies) and targeted at the same victim (or group of victims) (Berger, 2007).

	Direct	Indirect	
Physical	Hitting Kicking Pushing Shoving Spitting Tripping	Throwing things Extortion Damage of property Physical coercion Weapon usage	Persuasion of others to assault the victim Hiding/removing belongings
Verbal	Insults Offensive innuendos and nicknames Threats Extreme sarcasm	Mocking Unfair criticism Name calling Coercion Taunting	Defamation Persuasion of others to criticize/ insult the victim Anonymous phone calls
Gestural <sup>a</sup>	Tongue poking Finger signs Eye rolling Mocking imitation of someone's manners Laughing Pointing Staring Threatening/Obscene gestures		
Relational	Forming coalitions against someone Moving away when the victim approaches Ostracism Rejection	Telling false stories regarding the victim Malicious gossip Spreading rumors Persuasion of others to exclude someone	
Cyberbullying	Offensive, obscene, mean and/or threatening messages Posting inappropriate messages and/or images under the victim's identity Unauthorized publication of private info and/or images Defamation and exclusion on social networks		

a. Gestural bullying always concerns the bullies' body posture and the difference between direct and indirect forms is whether the actions are performed within or without the victims' sight.

**Figure 3.** Examples of behaviors representative of each form of bullying. *Adapted from Rigby (2003, p. 10)*

### 2.1.3. Participants

The bullying phenomenon goes beyond the bully/victim dyad, thus representing a social dynamic which is influenced and affected, either directly or indirectly, by peers (Craig & Pepler, 1995; Garandeau & Cillessen, 2006; O'Connell et al., 1999; Salmivalli et al., 1996; Strøm et al., 2013; Sutton & Smith, 1999). Moreover, observations of bullying in the playground revealed that peers were, at some extent, associated with this experience in 85% of its episodes (Craig & Pepler, 1995).

Thereby, children in school context can be actively or passively involved in bullying, fitting into one of the following roles: bully, victim, bully-victim, or bystander (see Figure 4) (Berger, 2007; Olweus, 2013; Salmivalli, 2010; Salmivalli et al., 1996). The latter category can be additionally divided into assistants, reinforcers, defenders or outsiders (Salmivalli et al., 1996). Moreover, bullying is typically believed to be a result of individual developmental pathways that predispose children to take part in the different roles of its dynamic (Rigby, 2004; Volk et al., 2012). These participant roles are also dependent on the contextual factors underlying the bullying situation (Salmivalli et al., 1996).

Thereby, the aggressive behavior displayed by the *bullies* may be explained by certain characteristics of their personalities (e.g. low empathy, aggressiveness, impulsiveness, manipulative skills, emotional immaturity and remorselessness); by a history of family violence and/or deficient parent supervision; and by deficits/distortions in social competence and cognitive mechanisms (Cook et al., 2010; Rigby, 2002, 2004; Volk et al., 2012). These children are always stronger than the victims, either physically, mentally or numerically (Olweus, 2013).

*Victims*, on the other hand, are considered to have submissive personalities marked by anxiousness, insecurity, low self-esteem, lack of assertiveness and retaliation, self-blaming tendencies and negative perception of self (Arseneault et al., 2010; Berger, 2007; Cook et al., 2010; Garandeau & Cillessen, 2006; Pellegrini, 1998; Wong & Schonlau, 2013). They may also come from negative family environments and often present lack of social skills, thus being socially rejected (Arseneault et al., 2010; Cook et al., 2010; Salmivalli et al., 1996).

Moreover, the same individual can display bullying behaviors in some situations and be victimized in other, depending on the context (Berger, 2007; Tinbergen, 1972; Wong & Schonlau, 2013). *Bully-victims* share personality characteristics and developmental problems with both bullies and victims, which puts them at higher risk for the negative outcomes of bullying (Arseneault et al., 2010; Cook et al., 2010; Wong & Schonlau, 2013). The aggressive behaviors presented by this group may represent a maladaptive response

to the victimization they suffer; that is, they may constitute redirected aggression (Wong & Schonlau, 2013).

Lastly, and because bullying is a social process, *bystanders* are peers that offer support to either bullies or victims at different levels (Salmivalli, 2010; Salmivalli et al., 1996). *Reinforcers* are those peers who encourage the bullies by laughing, cheering and providing an audience, hence functioning as a positive feedback mechanism (Dake et al., 2003; Salmivalli, 2010). *Assistants*, despite not having initiated the aggression, join in the bullying event and actively help the bully, assuming a follower role (Dake et al., 2003; Salmivalli, 2010). *Defenders* of the victims, who side with them, either provide comfort and support, or actively try to stop the bullying (by facing the bully or warning adults about it) (Dake et al., 2003; Nickerson & Melle-Taylor, 2014; Salmivalli, 2010). In turn, *outsiders* are those who stay outside the situation, either by ignoring the bullying or by withdrawing from it (Dake et al., 2003; Nickerson & Melle-Taylor, 2014; Salmivalli, 2010). The position adopted by this group is far from being neutral. In fact, no behavior exhibited by someone who witnesses bullying is neutral (Garandeanu & Cillessen, 2006). Reinforcers and assistants actively support bullying, defenders actively discourage it and outsiders, by witnessing it and not doing anything about it, provide tacit approval and reinforcement for the aggression (Atlas & Pepler, 1998; Craig & Pepler, 1995; Craig et al., 2000).

Nevertheless, one must acknowledge that it is possible the overlap of some behaviors, thus resulting in the assignment of different roles to the same individual, depending on the context (Nickerson & Melle-Taylor, 2014).

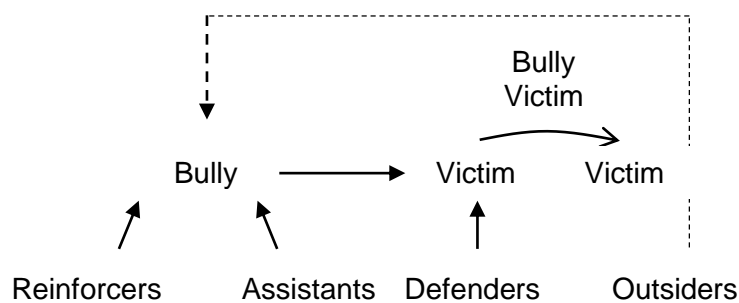


Figure 4. Schematic representation of the relationships between the roles of bullying

#### 2.1.4. Negative outcomes and severity

The bullying phenomenon entails numerous negative outcomes, not only for the victims but for the other participants as well (Berger, 2007; Evans et al., 2014; García & Margallo, 2014). These effects are placed “along a continuum of seriousness” (Rigby, 2002, p. 41) and depend on the frequency, duration and nature of the abuse, in addition to the individual characteristics of the participant (Novo et al., 2013; Rigby, 2002, 2003). As an example,

occasional episodes of name-calling or exclusion might be related with low levels of severity; more systematic and cruel actions such as threats and physical abuse might be involved with intermediate levels; and particularly damaging actions extended over a considerable period of time (serious physical assaults, total exclusion, among others) might result in highly severe consequences (Rigby, 2002).

Compared to children non-involved in bullying, *victims* report worse school performance and academic achievement; exhibit more physical health problems such as sleep disturbances, enuresis, headaches, abdominal pain, fatigue and neck, shoulder and back pain; and have lowered mental health, which reflects in depression, generalized anxiety, stress, schizophrenia and psychopathology (Arseneault et al., 2010; Dake et al., 2003; Novo et al., 2013; Vreeman & Carroll, 2007). Bullying victimization is, as well, correlated with a heightened risk for substance abuse, and for suicide ideation and both failed and successful suicide attempts (Hepburn et al., 2012; Tharp-Taylor et al., 2009). Moreover, there are reports of bullying-related homicides, often in the form of school shootings (Berger, 2007; Dake et al., 2003). In fact, the severity of the outcomes is increased by the co-occurrence of multiple types of victimization (Berger, 2007; Wang et al., 2010).

Like victims, *bullies* suffer more from psychological and physical disorders than non-involved children (Evans et al., 2014; Liang et al., 2007; Shaw et al., 2013; Vreeman & Carroll, 2007). This also holds true for the higher likelihood of risky behaviors as substance abuse or carrying weapons, social impairment, academic failure and suicide ideation (Evans et al., 2014; García & Margallo, 2014; Richards & Bernal, 1972; UNICEF, 2014). Additionally, repeatedly perpetrating bullying behaviors is highly correlated with criminal misconduct (Berger, 2007; Dake et al., 2003; García & Margallo, 2014; Olweus, 2011).

Bullying also impacts the lives of those who witness it. It's usual for *bystanders* to develop negative feelings towards the school environment, as well as to perform lower academically (Berger, 2007; Doğruer & Yaratan, 2014). Furthermore, peers may experience severe anxiety, stress, discomfort and fear of becoming the next victim (Atlas & Pepler, 1998; Doğruer & Yaratan, 2014). As Berger (2007, p. 107) stated, "children who see bullying, day after day, absorb harmful lessons: bystanders should not intervene; victims deserve their fate; power beats fairness; adults do not care about children".

Lastly, *bully-victims* are at most risk when compared with both non-involved children and the other participating groups, cumulating the deleterious effects of the bullies and the victims (Liang et al., 2007).

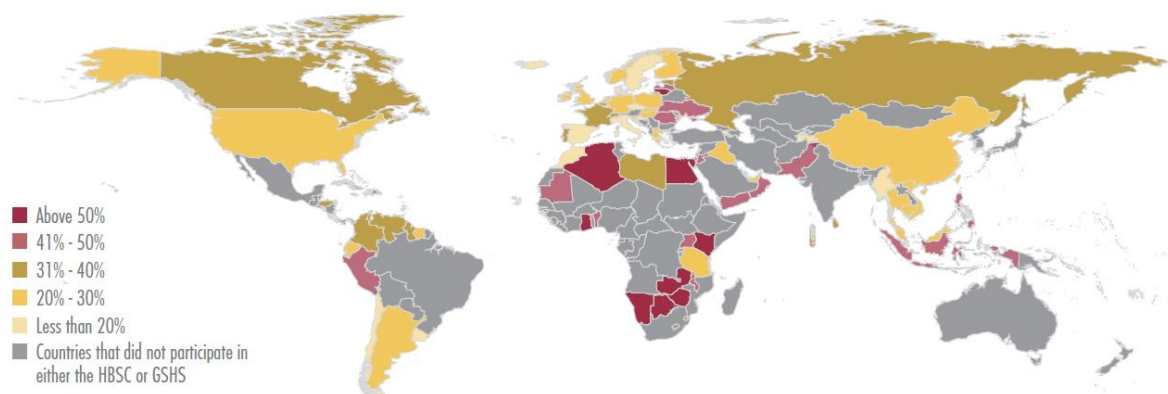
The concern about this phenomenon extends beyond a short-term perspective. Research indicates that the outcomes of being involved in bullying during childhood and adolescence

persist into adulthood, contributing to a generation of socially and emotionally maladjusted adults responsible for overloading social support systems (either due to unemployment, incapacity pensions or being in prison) (García & Margallo, 2014; Jiang et al., 2011; Kim et al., 2011; Klomek et al., 2008; Olweus, 2011, 2013).

As a result of both its short- and long-term effects, bullying is a matter extremely relevant in the medico-legal area. Therefore, it is particularly important a more comprehensive understanding of the phenomenon, aiming at a more successful intervention and prevention.

### 2.1.5. Prevalence

Bullying is a worldwide issue. Recently, the United Nations Children’s Fund published a report on violence against children where the results from large-scale studies were compiled and the range of this problem disclosed. According to the UNICEF’s publication, of the 106 countries with available data<sup>1</sup> (low-, medium-, and high-income nations), only 16 (≈ 15%) display percentages of reported bullying victimization<sup>2</sup> under 20%, revealing a substantial global prevalence of this phenomenon (see Figure 5) (UNICEF, 2014).



**Notes:** This map is stylized and not to scale. It does not reflect a position by UNICEF on the legal status of any country or territory or the delimitation of any frontiers. The dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. The final boundary between the Sudan and South Sudan has not yet been determined. The final status of the Abyei area has not yet been determined. Data from the HBSC were recalculated as weighted averages for 13- to 15-year-olds to allow for comparison with data collected in the GSHS. Reference periods for the two surveys differ slightly. Data for China, Colombia, Ecuador, State of Palestine, the Bolivarian Republic of Venezuela and Zimbabwe are not national but have been recalculated on the basis of subnational surveys that took place in selected cities in each country or area. Data for Belgium are a weighted average of the Flemish and French samples. Data for Ghana refer to students in junior high school only. Data for the United Kingdom are a weighted average of the samples in England, Scotland and Wales. Data for the United Republic of Tanzania are not national but represent only the city of Dar es Salaam.  
**Source:** HBSC, 2009/2010 and GSHS, 2003-2013.

**Figure 5.** Percentage, by country, of adolescents from 13 to 15 years of age who reported being bullied at least once in the past couple of months. From UNICEF (2014, p. 121)

The HBSC survey program, one of the sources of the UNICEF’s publication, was also implemented in Portugal. Regarding bullying behaviors<sup>3</sup>, 38.7% of Portuguese adolescents

<sup>1</sup> Data refers to adolescents from 13 to 15 years of age and to the most recent year available from a time range from 2003 to 2013 (UNICEF, 2014).

<sup>2</sup> At least once in the past couple of months (UNICEF, 2014).

<sup>3</sup> Data refers to adolescents of 11, 13 and 15 years of age and to the year 2014 (Matos et al., 2014).

reported being victimized in school in the past couple months, whereas 30.9% admitted having bullied others in the same time interval (Matos et al., 2014). These results, in line with those presented by UNICEF, reflect the normative character of the phenomenon, thus highlighting the importance of implementing prevention and intervention programs.

### **2.1.6. Intervention and prevention**

Several prevention and intervention programs are currently being implemented in schools around the world, focusing on various elements positively correlated with a decrease in bullying behaviors, such as: improvement of playground supervision; application of strict disciplinary methods; parent meetings and training; implementation of an anti-bullying policy encompassing the whole school community; and promotion of school conferences and use of institutional videos (Evans et al., 2014; Farrington & Ttofi, 2009; Ttofi & Farrington, 2009, 2011). Nevertheless, such programs have been shown to reduce bullying in about 20%, which is a somewhat limited success (Berger, 2007; Evans et al., 2014; Farrington & Ttofi, 2009; Frisé et al., 2012; Ttofi & Farrington, 2009, 2011; Vreeman & Carroll, 2007).

Since it results in numerous deleterious repercussions for all its participants and has a considerable prevalence worldwide, bullying is a phenomenon extremely relevant from a medico-legal point of view, thus becoming imperative the optimization of anti-bullying programs in order to maximize their success in reducing its occurrence and minimizing its effects.

### **2.1.7. Other Bullying Contexts**

Bullying is not exclusive to school settings. Other contexts where bullying has been reported include, among others, the workplace, prisons, military forces, sports teams, nursing homes, universities and domestic environments (Craig et al., 2000; Dođruer & Yaratan, 2014; Horton, 2011; Rayner & Hoel, 1997; Rigby, 2002). All these settings have in common the potential to generate power imbalances and, subsequently, to promote aggressive abuse of power.

In fact, every situation where individuals are required to interact with each other for a period of time and have a limited choice over whom to interact with are likely to foster bullying behaviors, thereby demonstrating the pervasive nature of the phenomenon (Horton, 2011; Rigby, 2002).

### **3. A look at school bullying through an ethological perspective**

#### **3.1. Is bullying adaptive?**

Childhood aggression is commonly regarded as the result of deficits and distortions in social information processing and cognitive mechanisms, as well as of the imitation of aggressive role-models. Likewise, bullying is typically considered as being the result of maladaptive development, coming up as a deviant way to cope with the environment (Archer, 2001; Volk et al., 2012). According to this perspective, besides being physically stronger than average, bullies tend to be more aggressive and less empathic; academically, socially and mentally challenged; probably coming from dysfunctional and oppressive households; and not integrated into their communities (Berger, 2007; Cook et al., 2010; Rigby, 2004).

However, this theory does not seem enough to explain the high prevalence and the ubiquity of the phenomenon (Volk et al., 2012). Moreover, and in addition to the fact that aggression may be a successful strategy in certain contexts, research has indicated that some children involved in bullying behaviors as perpetrators are generally smart and popular students and, mainly, do not lack social skills (Archer, 2001; Doğruer & Yaratan, 2014; Smith & Brain, 2000). In fact, they often possess various attributes commonly regarded by society as positive, such as assertiveness, risk taking, and leadership, organizational and analytical skills (Simplicio, 2013).

Additionally, children who engage in bullying behaviors seem to do so in a goal-directed manner, striving for power, admiration, high status and dominance (Olthof et al., 2011; Reijntjes et al., 2013; Simplicio, 2013; Weisfeld & Weisfeld, 2013). In fact, peers actually respect, like and acknowledge these children (Berger, 2007; Reijntjes et al., 2013; Simplicio, 2013).

Therefore, bullying may be more than just a set of maladaptive conducts, merely justified by the psychosocial traits of the individuals (Horton, 2011; Volk et al., 2012). An alternative hypothesis suggests that bullying may also serve an evolutionary purpose, which means that this kind of behaviors are probably strategic and possibly have an adaptive function (Book et al., 2012; Reijntjes et al., 2013; Rigby, 2002; Volk et al., 2012; Weisfeld & Weisfeld, 2013).

## **3.2. Bullying from an ethological standpoint**

### **3.2.1. On Aggression**

Aggressive conducts, due to their hostile nature and tendency to violate social norms, are typically seen as “socially incompetent behaviors” (Olthof et al., 2011, p. 340). However, from an evolutionary perspective, aggression is regarded as a set of functional responses, or strategies, to a number of problems that emerged in the course of evolution (Archer, 2001; Olthof et al., 2011).

Such conceptualization of aggression implies an inherent purpose. On his book *On Aggression* (1963), Konrad Lorenz described intra-specific aggression, or “aggression in the proper and narrower sense of the word” (p. 26), as having a species-preserving function. Aggression towards elements of the same species can be motivated by, essentially, three proximate goals: more mating opportunities (in order to, ultimately, perpetuate their genes); proper distribution of individuals (so the resources don’t become over-exploited); and hierarchical social organization (contributing to the stability and viability of the group, where everyone knows their place and where top positions usually entail preferential access to available resources) (Dugatkin, 2014; Lorenz, 1963; Morris, 1967; Olthof et al., 2011; Rigby, 2002).

Despite being displayed species-wide and presenting an adaptive component, aggression can be extremely costly. Engaging in aggressive behaviors involves a cost-benefit analysis, in which the costs of endangering one’s survival must be largely outweighed by the benefits accruing from such conducts. (Benenson, 2009; Dugatkin, 2014). This is probably the reason why asymmetrical fighting is the norm in the animal world, which includes human beings (Gat, 2010).

### **3.2.2. Social dominance**

Aggression is a key component in establishing dominance. Ethology regards social dominance not as an individual trait, but rather as a property of interpersonal relationships, which means that individuals only are dominant or submissive within a context of social interaction (Reijntjes et al., 2013; Savin-Williams, 1987; Watts, 2010). Accordingly, an individual is considered dominant when his/hers aggressive behaviors result in the peer’s submission (Martin, 2009; Olthof et al., 2011; Reijntjes et al., 2013; Watts, 2010).

When dyadic interactions occur frequently within a relatively cohesive group, it is possible to assort the elements of that group according to a rank order, thus resulting in dominance hierarchies (Barnard, 2004; Dugatkin, 2014; Martin, 2009; Strayer & Strayer, 1976). High

status individuals occupying top positions in dominance hierarchies are rewarded with preferential access to both material and social resources (Dugatkin, 2014; Gat, 2010; Hawley, 1999; Pellegrini, 2002; Pellegrini & Bartini, 2001; Reijntjes et al., 2013; Savin-Williams, 1987; Watts, 2010). Thereby, such hierarchical organization is a reflection of the power asymmetries between the individuals in a context of resource allocation (Hawley, 1999; Watts, 2010). As Pellegrini (2002, p. 26) stated, “dominance is not an end in and of itself, but is indicative of individuals’ access to desired resources”. Moreover, research indicates that dominance may be gratifying on its own (irrespective of other desired resources) due to the central role dominant individuals play within the social life of the group (Hawley, 1999; Savin-Williams, 1979).

The establishment of dominance-based hierarchies has also proven to be advantageous to the group as a whole, rather than just to those at the top, contributing to its viability and stability (Savin-Williams, 1979). By knowing their relative place in the social order, each member has the ability to predict and avoid intra-group aggression (due to the high probability of defeat) (Pellegrini, 2002; Savin-Williams, 1979, 1987; Strayer & Strayer, 1976; Watts, 2010).

Dominance hierarchies are commonly found in social species including, among others, ants, wolves, hyenas, non-human primates, and humans (Hawley, 1999; Martin, 2009; Savin-Williams, 1987; Strayer & Strayer, 1976; Volk et al., 2012; Watts, 2010).

### **3.2.3. Intra-specific aggression, dominance hierarchies and bullying: what relation?**

Considering the notions and purposes of aggression and social dominance addressed in the previous sections, it is possible to draw some parallels between these ethological concepts and bullying behaviors, thus supporting the theory that this phenomenon may have an adaptive basis.

Firstly, the expression of bullying constitutes an asymmetrical aggression and, likewise, is liable to entail costs and a cost-benefit evaluation (Pellegrini, 1998). The immediate costs for bullies include being caught and punished, retaliation and rejection, and the cost-benefit analysis they perform is reflected in the form of bullying in which they choose to engage (Archer, 2001; Pellegrini, 1998; Volk et al., 2012). For instance, direct physical aggression, despite being more effective in the short-run, is more risky than indirect relational forms (Archer, 2001). The diversity of bullying forms also suggests that each form may have resulted as a response to different selective pressures (Volk et al., 2012).

Bullying and intra-specific aggression possibly have some purposes in common as well. When confronted with why they engage in such behaviors, the bullies’ most frequent

answers are “to feel powerful” and “to look cool” (Reijntjes et al., 2013, p. 225), meaning that bullies are moved by a desire of occupying a central, dominant position in the group (Caravita & Cillessen, 2012; Olthof et al., 2011; Sutton & Smith, 1999). Accordingly, research indicates that bullies are actually perceived as popular, being both socially prestigious and influential (Caravita & Cillessen, 2012; Hawley, 1999; Juvonen & Galván, 2009; Olthof et al., 2011; Olweus, 2013; Sutton & Smith, 1999). Thereby, engaging in bullying behaviors is probably a way of achieving high levels of social dominance (Caravita & Cillessen, 2012; Pellegrini, 1998; Reijntjes et al., 2013).

Resorting to bullying to obtain social dominance is a frequent and well-studied occurrence in non-human social species. By the same token, some studies have found that humans also make use of asymmetrical aggressive behaviors to form dominance hierarchies, particularly children of all ages, from toddlers to adolescents (Hawley, 1999; Martin, 2009; Savin-Williams, 1976, 1979, 1980, 1987; Strayer & Strayer, 1976). Additionally, confined, “caged” settings, a category where schools usually fit, appear to favor aggression and vertical stratification (Martin, 2009; Rajecki, 1983).

Furthermore, and consistent with an adaptive perspective, bullying is also found to be positively correlated with high levels of resource control (Reijntjes et al., 2013, p. 25). Desirable resources for children and adolescents can be material, social and informational (Reijntjes et al., 2013, p. 25), and may include: preferential access to toys/other play related materials and to the most attractive sites within the schoolyard; food and money; esteem, respect and admiration from peers; and more dating opportunities (Book et al., 2012; Dake et al., 2003; Gat, 2010; Hawley, 1999; Pellegrini, 2002; Reijntjes et al., 2013; Savin-Williams, 1987; Volk et al., 2012). As a consequence of leading to such high rewards, bullying behaviors become self-reinforcing (Craig & Pepler, 1995; Craig et al., 2000; Potegal, 1979; Reijntjes et al., 2013).

In summary, bullying behaviors may constitute a coercive strategy to enhance one’s social status and achieve social dominance, as a means of acquiring desired resources.

### **3.3.3. Biological determinism?**

It is imperative, however, to recognize that being adaptive does not make the behavior inevitable, nor does predispositions entail fatalism (Juvonen & Galván, 2009; Savin-Williams, 1987; Volk et al., 2012). Prosocial behaviors constitute an equally, if not more, effective option in attaining high levels of dominance and in acquiring and controlling resources (Hawley, 1999; Reijntjes et al., 2013; Rigby, 2002).

By understanding why some children choose to engage in bullying behaviors, it is possible to adapt prevention and intervention programs in order to reduce the motivation to do so. Such programs may gain from improving the cost-benefit ratios of bullying, rather than by just increasing its costs through sanctions (Volk et al., 2012). This can be done, for instance, by offering prosocial alternatives to bullies and/or by resorting to the peer group to deprive them from an audience (Book et al., 2012; Craig et al., 2000; Olthof et al., 2011; Reijntjes et al., 2013; Salmivalli, 2010; Simplicio, 2013; Volk et al., 2012).

In conclusion, bullying neither is solely the result of a maladaptive development nor it is a predetermined, immutable set of behaviors. In fact, and as acknowledged by Gat (2010, p. 216), “there are highly complex interactions at work (...) underpinned by a simple evolutionary rationale”.

# OBJECTIVES

Although some studies have been conducted resorting to direct observations of bullying behaviors in school contexts, the majority of worldwide research on this matter has employed indirect measures. In accordance with the global trend, Portuguese research on the bullying phenomenon has also exclusively made use of surveys and questionnaires. In view of that, this study proposes an ethological approach to the study of school bullying.

More specifically, we aimed to, resorting to naturalistic observations, determine if groups of human adolescents are organized into a hierarchical order, and if there is a relationship between occupying a certain position in a dominance hierarchy and engaging in bullying behaviors.

In particular, we proposed:

1. To elaborate a catalog of the behaviors displayed by adolescents during recreation time in school;
2. To identify those behaviors related to dominance/submission and bullying;
3. To identify a dominance hierarchy;
4. To evaluate, per each member of the hierarchy, the frequency and time budget of the abovementioned behaviors;
5. To compare the data obtained.

Accordingly, our research hypotheses are:

1. Groups of human adolescents display rank orderings;
2. Individuals occupying top rank positions in the hierarchy display more frequently dominance behaviors but are not necessarily the most aggressive ones;
3. Individuals occupying bottom rank positions in the hierarchy display more frequently submissive behaviors;
4. The frequency of perpetrating bullying behaviors is higher in individuals aiming at the top rank positions in a hierarchy, thus being the most aggressive ones.

# METHODOLOGY

## 1. School characterization

The present study was conducted in Escola Básica do 2º e 3º Ciclos of São João da Madeira, a public school affiliated to the group of schools João da Silva Correia, and located in the center of the city.

São João da Madeira, situated in the north of the district of Aveiro and part of the Porto Metropolitan Area, is a city with 21.713 inhabitants. Regarding the instructional levels of its residents, the most frequent educational rate found is the 1st cycle, followed by secondary education and the 3rd cycle. Because it is an industrial city mainly devoted to the shoe industry, most of its active population consists of workers belonging to level 7 of C.N.P.<sup>4</sup> – Operários, Artífices e Trabalhadores Similares<sup>5</sup> (Instituto Nacional de Estatística, 2012).

The school comprises a total of 732 students, 650 of which, aged 9 to 17 years, are matriculated in regular education over five levels of education (5th to 9th grade). The remaining 82 students, whose ages range between 14 and 19 years, are enrolled in vocational education which is, in turn, divided into 3 levels (from 10th to 12th year) (see Figure 6).

Type of Education	Age Range (Years)	Educational Level	Number of Classes	Number of Students	Total number of Students	
Regular	9-17	5 <sup>th</sup>	7	167	650	732
		6 <sup>th</sup>	8	187		
		7 <sup>th</sup>	6	127		
		8 <sup>th</sup>	5	91		
		9 <sup>th</sup>	4	88		
Vocational	14-19	10 <sup>th</sup>	1	29	82	
		11 <sup>th</sup>	1	23		
		12 <sup>th</sup>	1	20		

**Figure 6.** Characterization of the student population attending the E.B. 2,3 school in São João da Madeira during the academic year of 2014/2015

Among the school facilities there are 2 entrances, 5 classroom blocks, 1 administration and secretary block, 1 teachers' room, 1 recreation room, 1 cafeteria (F), 1 canteen (G), 1 library (H), 1 study room (I), 4 multipurpose rooms (J), 1 gymnasium (K), 3 sports grounds (L), 1 storage unit (M), and 1 private parking lot (N) (see Figure 7).

<sup>4</sup> Classificação Nacional das Profissões – National Classification of Occupations

<sup>5</sup> Operários, Artífices e Trabalhadores Similares – Workers, Craftsmen and Similar

The school staff consists of 20 operational workers and three technical assistants, distributed by all the school functions and facilities.



**Figure 7.** Architectural plan of the school complex. A – Entrance; B – Classroom block; C – Administration and secretary block; D – Teachers’ room; E – Recreation room; F – Cafeteria; G – Canteen; H – Library; I – Study room; J – Multipurpose rooms; K – Gymnasium; L – Sports ground; M – Storage unit; N – Parking lot

## 2. Sample characterization

As discussed in more detail in the section *Experimental Protocol*, this study was divided into two phases, each with a different sample.

The sample corresponding to phase A comprised all 732 students currently enrolled in school (see Figure 6). In turn, phase B sample was composed of six male students, aged 13 to 16 years (see Figure 8). For ethical reasons, and in order to maintain anonymity, these students were identified by resorting to an alphabetic code (see section *Ethical considerations*).

Subject	Age (Years)	Subject	Age (Years)
A	15	D	13
B	16	E	14
C	14	F	13

**Figure 8.** Age characterization of the phase B sample

### 3. Criteria for site and sample selection

Concerning the choice of where to conduct this study, decisions had to be taken at three levels: first, what kind of institution would be more suitable; second, in which particular institution; and lastly, where in particular within that chosen institution.

To begin with, and considering both the purposes of the research and the restrictions externally imposed to its execution, the assessment of bullying behaviors was chosen to be carried out in school settings. This was due, not only to the easiness and promptness in obtaining the required authorizations when compared with other contexts, but also to the existence of a vast literature on the matter that served as a guide for the research design. Secondly, the choice fell on Escola Básica do 2º e 3º Ciclos of São João da Madeira, because of its accessibility and the regular education age range it comprises (9-16). Finally, the within-school location selected was the playground, specifically the recreation room and the outdoor area surrounding the library. These were the places with greater freedom of conduct for students and where the observer could pass unnoticed more easily, in an attempt to reduce their reactivity to the presence of a strange figure. Additionally, and because the observations were carried out during the winter, the choice fell on these places for being the ones that provided shelter to the students in case of bad weather.

In regard to sample selection, the present research followed Lehner's (1996) indications.

Accordingly, phase A sample was haphazard because it wasn't systematically selected and comprised all students present during the observation periods (hypothetically all of the 732 students matriculated). In turn, the sample taken in phase B, since it consisted of only six male students (see figure 8) identified because they formed a relatively cohesive group that continually exhibited a pattern of behaviors relevant to the study, is an opportunistic sample.

### 4. Observation protocol

All 105 observations were held during the morning breaks, from 10h00 to 10h15 and from 11h45 to 12h00, making a total of 1575 minutes of observation (see Figure 9).

Phase		Number of Observations	Minutes of Observation
A	A1	21	315
	A2	44	660
B		40	600
Total		105	1575

**Figure 9.** Number of observations and respective duration in minutes, per phase and in total

Moreover, the observations were carried out in such locations that allowed, simultaneously, a wide field of view into the chosen site (e.g. recreation room) and the researcher to pass unnoticed (see Figure 10).



**Figure 10.** Representation of the observation sites and of the area covered by the researcher field view. The yellow circles indicate the different positions assumed by the researcher during the observations while the red area represents the total area of sight (a combination of the field views of the researcher for each observation position).

The naturalistic observations featured in the present research were allocated into two different phases based on the sampling method implemented.

## 4.1. Phase A observations

All observations conducted in phase A resorted to an *ad libitum* sampling method, a technique that consists in recording all that is observable without any restraints (Altmann, 1974; Lehner, 1996).

Phase A was further divided into two sub-phases, A1 and A2, according to the goals of the observations.

### 4.1.1. Phase A<sub>1</sub>: elaboration of a behavioral catalog

The main objective of phase A1 was the development of a behavioral catalog representative of the behaviors displayed by the students in their leisure time. It served not only to understand how students behaved during their breaks, but also to accustom them to the presence of a stranger.

The resultant list of behaviors, as well as their detailed description, was based mostly on the works of Berdecio and Nash (2009), Primate Foundation of Arizona (2009), Savin-Williams (1987) and Strayer and Strayer (1976) (see Figure 11).

SPECIES – COMMON NAME: Human
SPECIES – SCIENTIFIC NAME: <i>Homo sapiens</i>
DESCRIPTION: Adolescent behavior at recess

FUNCTIONAL CATEGORY	DETAILED DESCRIPTION OF THE BEHAVIOR
A. Agonism	“Board term used to define non-friendly interactions. May or may not include actual body contact.” (Primate Foundation of Arizona, 2009)
A1. Physical attack	
A1.1. Chase	When, in an aggressive context, one individual runs fast after another. The victim may be screaming while fleeing.
A1.2. Shove	When one individual pushes another in a rough manner.
A1.3. Hit	When an individual strikes another, manually or with an object, in a quick and forceful way.
A1.4. Kick	When an individual strikes violently another with the foot.
A1.5 Push-Pull	When an individual exerts force on another in order to cause its movement onward and/or backward.
A1.6. Grab	When an individual harshly grasps or seizes another.
A1.7. Wrestle	When two individuals engage in a close fight without weapons.
A2. Verbal Attack	
A2.1. Verbal directive	When an individual gives another an authoritative instruction/suggestion.
A2.2. Verbal ridicule	When an individual subjects another to a scornful and dismissive language.
A3. Threat	
A3.1. Verbal	When an individual verbally challenges another, usually with threat of bodily harm. (Savin-Williams, 1987)
A3.2. Physical	When an individual physically challenges another, without making actual physical contact (e.g. standing in the way and simulating an attack).

A3.2.1. Intention hit	When an individual simulates a hit as a statement of an intention to inflict hostile action over another.
A3.2.2. Intention kick	When an individual simulates a kick as a statement of an intention to inflict hostile action over another.
A3.2.3. Intention charge	When an individual simulates a rush forward in attack as a statement of an intention to inflict hostile action over another.
A.3.2.4. Face/body posture	When an individual displays a set of nonverbal signals as a statement of an intention to inflict hostile action over another (e.g. raised and protruding chin and a slight forward lean of the upper trunk, often with one or both hands resting on the hips). (Strayer & Strayer, 1976)
A4. Physical/Object Displacement	
A4.1. With physical contact	When an individual uses physical contact to take an object or a position away from another.
A4.2. Without physical contact	When an individual doesn't use physical contact to take an object or a position away from another.
A5. Submission	
A5.1. Cry scream	When an individual vocalizes a crying scream as a response to initiated agonism.
A5.2. Rapid flight	When an individual rapidly flees from another as a response to initiated agonism.
A5.3. Cringe	When an individual bends the head and body in fear and apprehension.
A5.4. Hide	When an individual keeps out of sight as a response to initiated agonism or to avert agonistic situations.
A5.5. Hand cover	When an individual covers the head and body with the hand as a response to initiated agonism.
A5.6. Flinch	When an individual reacts to fear or pain with a quick and nervous movement of the head or body.
A5.7. Withdraw	When an individual leaves a place or situation as a response to initiated agonism.
A5.8. Avoid	When an individual keeps away from another/others as a response to initiated agonism or to avert agonistic situations.
A5.9. Watch	When an individual observes attentively another/others in a submissive and conformable manner.
A5.10. Request cessation	When an individual directly requests the cessation of the agonistic behavior (e.g. "Stop", "Leave me alone", "Leave me be").
A6. Counterattack	When an individual, after being attacked, displays behaviors accountable as forms of initiated agonism.
B. Information gathering & learning	
B1. Attentional behavior	
B1.1. Stare	When an individual looks fixedly at someone/something with the eyes widely open.
B1.2. Watch	When an individual observes someone/something attentively over a period of time.
C. Nutrient acquisition	
C1. Ingest	
C1.1. Eat	When an individual takes food into the mouth, chews it and swallows it.
C1.2. Drink	When an individual takes liquid (a drink) into the mouth and swallows it.
C2. Social acquisition of food	
C2.1. Buy food	When an individual pays for food; occurs in specialized places (e.g. vending machines and school cafeterias).
C2.2. Request food	When an individual asks another for food (usually "a bite").
C2.3. Share food	When an individual gives a portion of food to another (either following a request or not).
D. Play	To play: to engage in an activity for enjoyment and recreation. Usually accompanied by a smile (play face) and laughter (play vocalization) (Berdecio & Nash, 2009; Primate Foundation of Arizona, 2009)
D1. Solitary play	
D1.1. Object play	When an individual plays alone with an object (e.g. ball, cellphone, etc.).

D1.2. Motor play	When an individual plays alone without an object (e.g. skipping, jumping, hanging on handrails, etc.).
D2. Social play	
D2.1. Object play	When a group of individuals play together with an object (e.g. football, ping pong, volleyball, football with rocks, etc.).
D2.2. Motor play	When a group of individuals play together without an object (e.g. tickling, etc.).
D2.2.1. Play chase	When an individual (or individuals) pursue another (or others) in a playful context, accompanied by a smile and laughter.
D2.2.2. Rough & Tumble	When a group of individuals engage in vigorous and fast-paced movements such as hitting, pulling and wrestling; it differs from agonism since it's always accompanied by a play face and/or laughter (Primate Foundation of Arizona, 2009).
E. Social Integration	
E1. Bonding	
E1.1. Embrace	When an individual holds another closely in his/her arms, especially as sign of affection.
E1.2. Arm in arm	When two or more individuals walk or stand with their arms linked as a sign of affection.
E1.3. Hold hands	When two or more individuals clasp each other by the hand, typically as a sign of affection.
E1.4. Kiss	When an individual touches another with his/her lips as a sign of affection.
E1.5. Arm around	When an individual puts his/her arm around another one's shoulders.
E1.6. Paternalistic touch	When an individual touches another in a protective manner. Can take any of the bonding forms mentioned above.
E2. Greeting behavior	
E2.1. Handshake	When an individual shakes another one's hand with his/her own as a greeting.
E2.2. Kiss	When an individual touches another with his/her lips as a greeting.
E3. Movement coordination behavior	
E3.1. Buddy walk	When a group of individuals walk side by side; may or may not include arm in arm, holding hands and arm around.
E3.2. Wait	When an individual sets off and then waits for another if the companion is not following.
E4. Spatial adjustment	
E4.1. Approach	When an individual moves towards another (or others).
E4.2. Follow	When an individual goes after another (or others).
E4.3. Withdraw	When an individual leaves a place or situation.
E5. Solicitation-Invitation	
E5.1. Play Invitation	When an individual jumps up on or pushes another in a friendly and playful context.

**Figure 11.** Catalog compiling the behaviors displayed by the students during their time in-between classes.

#### **4.1.2. Phase A<sub>2</sub>: identification of the elements of a group**

In turn, the aim of phase A<sub>2</sub> observations was the identification of a number of individuals clearly belonging to the same group in order to assess the dominance relationships established between them.

During these observations six individuals were identified as belonging to the same group, constituting the sample for the following phase (see Figure 8).

## 4.2. Phase B observations

The fact that phase B observations, despite having different goals, were carried out simultaneously is the reason why this phase is not further subdivided.

All the observations conducted in phase B were based on a list of dominance-related behaviors derived from the behavioral catalog achieved in phase A1 (see Figure 12).

PHYSICAL ATTACK (PA) *	
X initiates an aggressive physical interaction with Y. Y either responds submissively or loses in case of a counterattack. (X→Y)	Chase, Shove, Hit, Kick, Push-Pull, Grab, Wrestle, Rough & tumble play
VERBAL ATTACK (VA) *	
X initiates an aggressive verbal interaction with Y. Y either complies or does not contradict. (X→Y)	Verbal directive; verbal ridicule
THREAT (TR) *	
X assumes an authoritative posture towards Y, who complies. (X→Y)	Verbal; Physical (intention hit, intention kick, intention charge, face/body posture)
PHYSICAL/OBJECT DISPLACEMENT (POD) *	
X takes an object or a position away from Y. (X→Y)	With physical contact; without physical contact
SUBTLE DOMINANCE (SD)	
X assumes a leading position towards Y without displaying overt forms of dominance or X ignores/disregards Y's interactions, regardless of their nature (aggressive or not) (X→Y; Y→X→Y)	Play invitation; paternalistic touch; ignoring/disregarding others
COUNTER DOMINANCE (CD)	
X, when attacked or threatened by Y, either counterattacks or does not comply. Y loses or settles. (Y→X→Y)	Verbal; Physical
RECOGNITION (RG)	
Y, actively or passively, seeks to place X in a more powerful position. (Y→X)	Greeting behavior (handshake); movement coordination behavior (wait); spatial adjustment (approach, follow, withdraw, avoid); attentional behavior (watch)
SUBMISSION (SB)	
Y displays submissive behaviors towards X in order to stop or avoid the threat/aggression. (Y→X; X→Y→X)	Cry scream; rapid flight; cringe; hide; flinch; withdraw; request cessation

**Figure 12.** List of dominance-related behaviors. X represents the winners of the interactions while Y stands for the losers. Recognition (RG) and Submission (SB) behaviors initiated by Y and directed to X were accounted as a victory by X/loss by Y. Categories marked with an asterisk (\*) comprise behaviors that, when markedly intentional and occurring in a clear power imbalance, can be considered bullying.

### 4.2.1. Dyadic interaction matrix

In order to unfold the hierarchical organization of the group identified in phase A2, and according to the ethological premise that an individual to be considered dominant over another needs to win significantly more encounters with that particular other than it loses, the victories of each member within the group were entered into a matrix, per observation (see Appendix B, section *Dyadic interaction matrix*). For this purpose, submission (SB) and

recognition (RG) behaviors were accounted as victories of the receiver (see Figure 12). Moreover, all these observations were conducted using a focal sampling technique.

#### **4.2.2. Instantaneous sampling of the subjects' behavior**

With the purpose of determining an approximation of the time spent in each behavior (in general and per individual) we resorted to a focal instantaneous sampling (see Appendix B, section *Instantaneous sampling of the subjects' behavior*). Accordingly, the behavior exhibited by the members of the group was recorded five times every 30 seconds, making a total of 2.5 minutes (150 seconds) of sampling period per element and per observation. Because the subjects might not be within the researcher's field of view the entire 15 minutes of the interval, the starting order of observation was often changed (although on a regular basis, e.g.: **A-B-C-D-E-F**; **B-C-D-E-F-A**; **C-D-E-F-A-B**; and so forth) so that all the members of the group were equally observed.

#### **4.2.3. Frequency of bullying behaviors**

Whenever a dominance-related behavior was perpetrated in a clear imbalance of power and was markedly intentional, it was accounted as a bullying behavior. Because the observations had to be carried out from a distance that minimized the subjects reactivity, the only criteria for considering a behavior imbalanced in terms of power was the physical or numerical strength. Moreover, the intentionality of the behavior was assessed taking into account the perpetrator's body posture (e.g. insisting on the behavior) and the receiver's reaction and expression (e.g. fleeing; sad face). To register the frequencies of bullying behaviors was employed a focal sampling method (see Appendix B, section *Frequency of bullying behaviors*).

#### **4.4. Ethical considerations**

The present study, because it involved underage children, had to be sensitive to a number of ethical issues.

The first concern was the protection of the identity of the subjects. In order to avoid reactivity and to ensure the genuineness of the behaviors, the subjects were unaware of the intentions of the researcher. Therefore, the identification of the members was conducted resorting to an alphabetical code.

The second concern was the duty to report dangerous behavior. For that reason, it was agreed with the school director that every conduct that represented a serious risk for the safety of the students should be reported.

This study received authorization to be conducted by the director of the school where it was implemented (see Appendix C) and was approved by the Ethics Committee of the Institute of Biomedical Sciences Abel Salazar of University of Porto – ICBAS-UP (see Appendix D).

## 5. Data treatment

### 5.1. Treatment of reversals

Once all of the observations were completed, the total frequencies of victories among all dyads of the group were gathered into a single matrix. However, and because the only criterion for the introduction of group elements into the matrix was alphabetical (A-B-C-D-E-F), this matrix did not reflect any other particular order. Thereat, in order to achieve a possible hierarchical ordering of the individuals, we proceeded to the treatment of reversals - situations in which an individual wins over another that, in turn, won the majority of the encounters between the two – by rearranging the distribution of the elements so that these "reversed" cases were allocated, as far as possible, below the diagonal (Lehner, 1996; Zivin, 1983).

### 5.2. Linearity and dominance indices

In order to ascertain which personal factors are possibly related to the position an individual occupies in a dominance hierarchy, it is necessary that the rank order is linear (or, at least, almost linear) (van Dierendonck et al., 1995). To evaluate one's position within a hierarchy – that is, in relation to the other members of the group – we resorted to Landau's Linearity Index ( $h$ ) (Figure 13). This index relates the total number of members of the group to the number of the elements of that group dominated by each individual, and ranges from 0 to 1, wherein  $h \geq 0.9$  indicates a sufficiently strong linearity value (Lehner, 1996; van Dierendonck et al., 1995).

$$h = \left( \frac{12}{n^3 - n} \right) \sum_{a=1}^n \left[ v_a - \frac{(n-1)}{2} \right]^2$$

**Figure 13.** Landau's linearity index equation.  $n$  indicates the number of group elements, while  $v_a$  stands for the number of group elements dominated by "a";  $h$  ranges from 0 to 1 (Lehner, 1996, p. 333).

In addition to assess the relative position a particular individual holds within a hierarchy, it was also pertinent to measure how dominant that individual is within that same group. This measurement was done by calculating the dominance index (*DI*) of each element of the hierarchy (Figure 14). Dominance indices reflect the ratio between the number of victories of each group member (*W*) and the total number of encounters with the other members (*T*), and vary from 0 to 1 (Lehner, 1996).

$$DI = \frac{W}{T}$$

**Figure 14.** Dominance index equation. *W* represents each member's total number of victories in dyadic interactions and *T* indicates each member's total number of interactions with others; *DI* varies from 0 to 1 (Lehner, 1996, p. 336).

### 5.3. Statistics

The software used to perform the statistical analysis was IBM SPSS Statistics for Windows, version 23.0 (IBM Corp., 2015).

To proceed with the statistical analysis, the six members of the hierarchy were allocated into four groups, according to their relative dominance: the “dominant” group, encompassing the most dominant individual (B); the second dominant group – “Hier2”, including the individual occupying the number two position in the hierarchy (A); the “omega” group, covering the most submissive individual (D); and the “others” group, including the other elements of the hierarchy (C, E and F). According to the dominance indices, the most submissive element would be F instead of D. However, and because F interacted very few times and only with some members of the group and D displayed more submission and recognition behaviors than the others, F was allocated into the “others” group, whereas D was allocated into the “omega” group.

In a first level of analysis, some descriptive statistics were computed, comprising such parameters as the total number of cases, the minimum and maximum values, and the arithmetic mean and standard deviation values.

In the second level of analysis we resorted to nonparametric statistical testing (particularly due to our small samples), and more specifically to the Kruskal-Wallis test (because we had more than three independent samples) to assess if there were significant differences in the distribution of dominance-related behaviors across the various dominance categories. Post hoc tests based on the Dunn-Bonferroni method were automatically performed following significant Kruskal-Wallis test results in order to evaluate the significance of those

differences across pairs of the dominance categories. The level of significance considered was  $p < 0.05$ .

### 5.3.1. Statistical hypotheses

In Statistics, the null hypotheses ( $H_0$ ) are the ones that the researcher tries to reject in order to be able to accept the alternative hypotheses ( $H_a$ ), equivalent to the research hypotheses and the ones that the researcher wants to verify (Lehner, 1996).

Accordingly, our null ( $H_0$ ) and alternative hypotheses ( $H_a$ ), both general and specific, are:

- $H_a$  1: The distribution of the frequency of dominance-related behaviors is significantly different across categories of dominance.
  - $H_a$  1.1: The distribution of the frequency of PA is significantly different across categories of dominance.
  - $H_a$  1.2: The distribution of the frequency of VA is significantly different across categories of dominance.
  - $H_a$  1.3: The distribution of the frequency of TR is significantly different across categories of dominance.
  - $H_a$  1.4: The distribution of the frequency of POD is significantly different across categories of dominance.
  - $H_a$  1.5: The distribution of the frequency of SD is significantly different across categories of dominance.
  - $H_a$  1.6: The distribution of the frequency of CD is significantly different across categories of dominance.
  - $H_a$  1.7: The distribution of the frequency of RG significantly different across categories of dominance.
  - $H_a$  1.8: The distribution of the frequency of SB is significantly different across categories of dominance.
  
- $H_a$  2: The distribution of the duration of dominance-related behaviors is significantly different across categories of dominance.
  - $H_a$  2.1: The distribution of the duration of PA is significantly different across categories of dominance.
  - $H_a$  2.2: The distribution of the duration of VA is significantly different across categories of dominance.
  - $H_a$  2.3: The distribution of the duration of TR is significantly different across categories of dominance.

- H<sub>a</sub> 2.4: The distribution of the duration of POD is significantly different across categories of dominance.
  - H<sub>a</sub> 2.5: The distribution of the duration of SD is significantly different across categories of dominance.
  - H<sub>a</sub> 2.6: The distribution of the duration of CD is significantly different across categories of dominance.
  - H<sub>a</sub> 2.7: The distribution of the duration of RG significantly different across categories of dominance.
  - H<sub>a</sub> 2.8: The distribution of the duration of SB is significantly different across categories of dominance.
- H<sub>a</sub> 3: The distribution of the frequency of dominance-related behaviors is significantly different across pairs of categories of dominance<sup>6</sup>.
    - H<sub>a</sub> 3.1: The distribution of the frequency of PA is significantly different across pairs of categories of dominance.
    - H<sub>a</sub> 3.2: The distribution of the frequency of VA is significantly different across pairs of categories of dominance.
    - H<sub>a</sub> 3.3: The distribution of the frequency of TR is significantly different across pairs of categories of dominance.
    - H<sub>a</sub> 3.4: The distribution of the frequency of POD is significantly different across pairs of categories of dominance.
    - H<sub>a</sub> 3.5: The distribution of the frequency of SD is significantly different across pairs of categories of dominance.
    - H<sub>a</sub> 3.6: The distribution of the frequency of CD is significantly different across pairs of categories of dominance.
    - H<sub>a</sub> 3.7: The distribution of the frequency of RG significantly different across pairs of categories of dominance.
    - H<sub>a</sub> 3.8: The distribution of the frequency of SB is significantly different across pairs of categories of dominance.
- H<sub>a</sub> 4: The distribution of the duration of dominance-related behaviors is significantly different across pairs of categories of dominance<sup>6</sup>.
    - H<sub>a</sub> 4.1: The distribution of the duration of PA is significantly different across pairs of categories of dominance.

---

<sup>6</sup> The pairwise comparisons were only made for those distributions found to have statistically significant differences. However, in the moment of stating hypotheses all types of behavior were considered because the analysis was yet to be made.

- H<sub>a</sub> 4.2: The distribution of the duration of VA is significantly different across pairs of categories of dominance.
  - H<sub>a</sub> 4.3: The distribution of the duration of TR is significantly different across pairs of categories of dominance.
  - H<sub>a</sub> 4.4: The distribution of the duration of POD is significantly different across pairs of categories of dominance.
  - H<sub>a</sub> 4.5: The distribution of the duration of SD is significantly different across pairs of categories of dominance.
  - H<sub>a</sub> 4.6: The distribution of the duration of CD is significantly different across pairs of categories of dominance.
  - H<sub>a</sub> 4.7: The distribution of the duration of RG is significantly different across pairs of categories of dominance.
  - H<sub>a</sub> 4.8: The distribution of the duration of SB is significantly different across pairs of categories of dominance.
- 
- H<sub>a</sub> 5: The distribution of the frequency of bullying behaviors is significantly different across categories of dominance.
  - H<sub>a</sub> 6: The distribution of the frequency of bullying behaviors is significantly different across pairs of categories of categories of dominance.

The respective null hypotheses state that the described distributions are the same across categories (and pairs of categories) of dominance.

### **5.3.2. Statistical variables**

Variables are attributes that can assume different values. Independent variables are those attributes that change and probably affect the dependent variables. In turn, dependent variables are the ones believed to be affected by changes in independent variables (Lehner, 1996).

In view of that, our variables are:

- Dependent variables: frequency and duration of dominance-related behaviors (PA; VA; TR; POD; SD; CD; RG; SB; Other; OOS); frequency and duration of other behaviors and out-of-sight time (Other; OOS); frequency of bullying behaviors.
- Independent variables: dominance categories (dominant; hier2; others; omega).

# RESULTS

## 1. Pre-statistical analysis

### 1.1. Dyadic interaction matrix

The results of the dyadic encounters, once the reversal cases were treated, allowed to establish a possible hierarchical organization of the identified group, with B occupying the top rank position in the hierarchy and F occupying its basis: (B-A-C-E-D-F) (see Table 1).

**Table 1.** Dyadic interaction matrix showing a possible hierarchical order of the group members, rearranged after the treatment of reversals

		Loser					
		B	A	C	E	D	F
Winner	B	---	9	5	11	36	3
	A	3	---	4	0	21	2
	C	2	3	---	0	10	1
	E	0	0	0	---	19	0
	D	1	1	0	0	---	0
	F	0	0	0	0	0	---

### 1.2. Linearity

As previously described, it is required that a hierarchy is linear (or almost linear) in order to assess the individual factors that are possibly related to different hierarchical ranks (van Dierendonck et al., 1995). Table 2 shows that the calculated linearity index of the identified group is 0.969, allowing the conclusion that this hierarchy is sufficiently linear to study the possible relation of bullying perpetration and rank positions ( $h \geq 0.9$ ) (see Table 2).

**Table 2.** Calculation of Landau's linearity index ( $h$ ) for the analysed hierarchy.  $n$  indicates the number of group elements, while  $v_a$  stands for the number of group elements dominated by "a";  $h$  ranges from 0 to 1 (Lehner, 1996, p. 333).

Subject	$v_a$ <sup>1</sup>	$\left[ v_a - \frac{(n-1)}{2} \right]^2$	Landau's Linearity Index ( $h$ )
			$h = \left( \frac{12}{n^3 - n} \right) \sum_{a=1}^n \left[ v_a - \frac{(n-1)}{2} \right]^2$
B	5	6,25	$h = 0,969$
A	3	0,25	
C	2	0,25	
E	1	2,25	
D	0,5	4	
F	0,5	4	

<sup>1</sup>  $v_a = 1$  for each member dominated plus 0,5 by each equal rank member (e.g. D and F)

### 1.3. Dominance indices

The calculation of the dominance indices for the individuals belonging to the identified group confirms the dyadic encounters results: subject B, holding the top rank position in the hierarchy, presents the highest dominance index ( $DI = 0.913$ ), followed by subjects A ( $DI = 0.697$ ), C ( $DI = 0.640$ ), E ( $DI = 0.63(3)$ ), D ( $DI = 0.023$ ) and F ( $DI = 0$ ) (see Table 3). According to these indices, the most submissive element would be F. However, F interacted very few times and only with some members of the group (see Table 1), suggesting that its position in the hierarchy based on the dominance index may not be representative of the reality. Considering the rest of the elements and their total number of interactions, D may be the most submissive individual instead (see Tables 1 and 3).

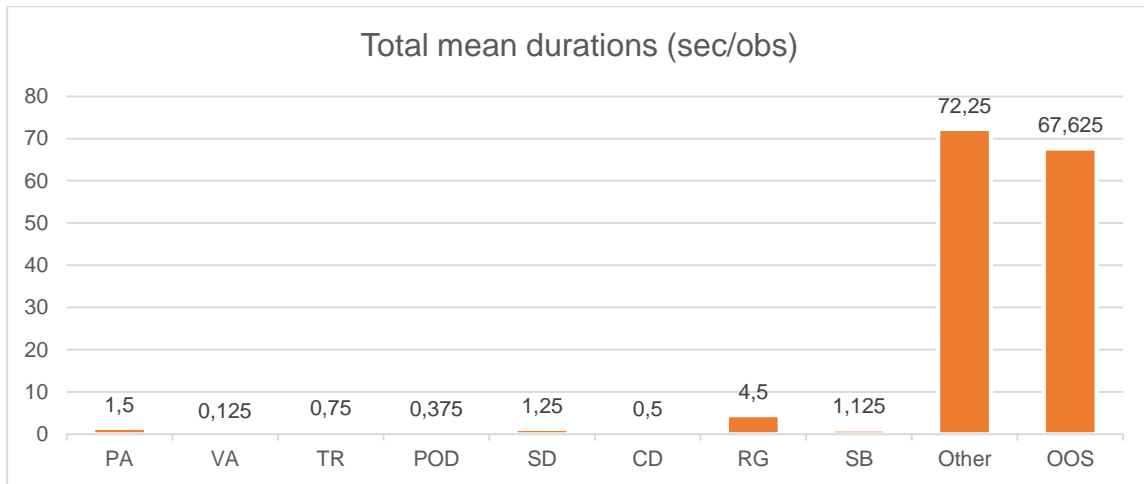
**Table 3.** Number of wins, losses and encounters per subject, as well as the respective dominance indices. Dominance indices ( $DI$ ) are calculated by dividing the number of wins ( $W$ ) of each element of the group by their total number of encounters with others ( $T$ ), and vary between 0 and 1 (Lehner, 1996, p. 336).  $DI$  values are presented rounded to three decimal places.

	Wins	Losses	Total number of encounters	Dominance index $DI = \frac{W}{T}$
Subject B	63	6	69	0,913
A	30	13	43	0,697
C	16	9	25	0,640
E	19	11	30	0,63(3)
D	2	86	88	0,023
F	0	6	6	0

## 2. Statistical analysis

### 2.1. Descriptive statistics

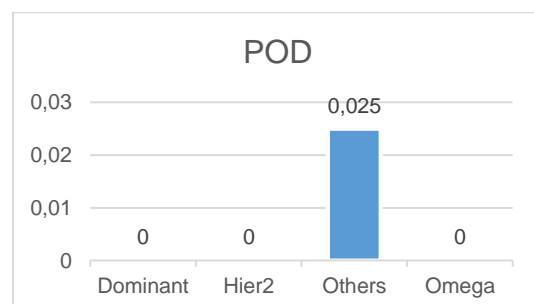
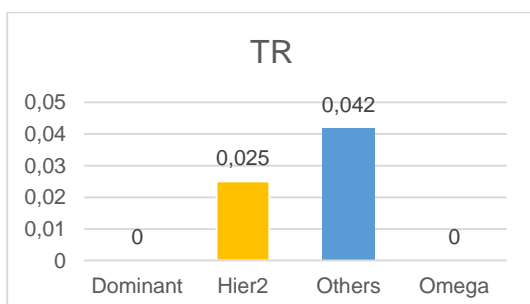
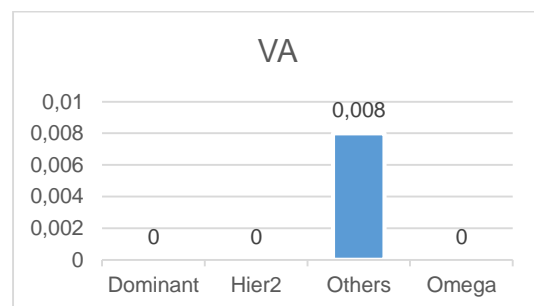
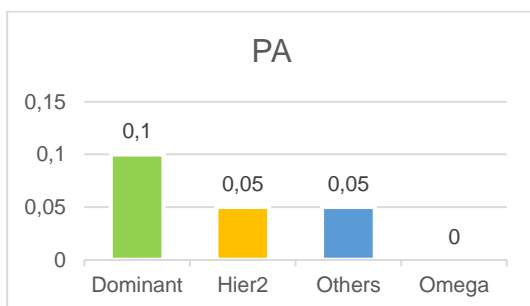
As can be seen in Figure 15, the group under analysis expended almost half the observation time in activities not directly related to dominance/submission behaviors. In fact, the subjects altogether spent a mean of 72,25 seconds in *Other* behaviors from the total of 150 seconds that each individual observation comprised (approximately 48%) (Figure 15). These behaviors included chatting, playing, eating, going to the toilets, and so on. Additionally, they spent 45% of the observation time out of the observer's field of view (OOS) (Figure 15).

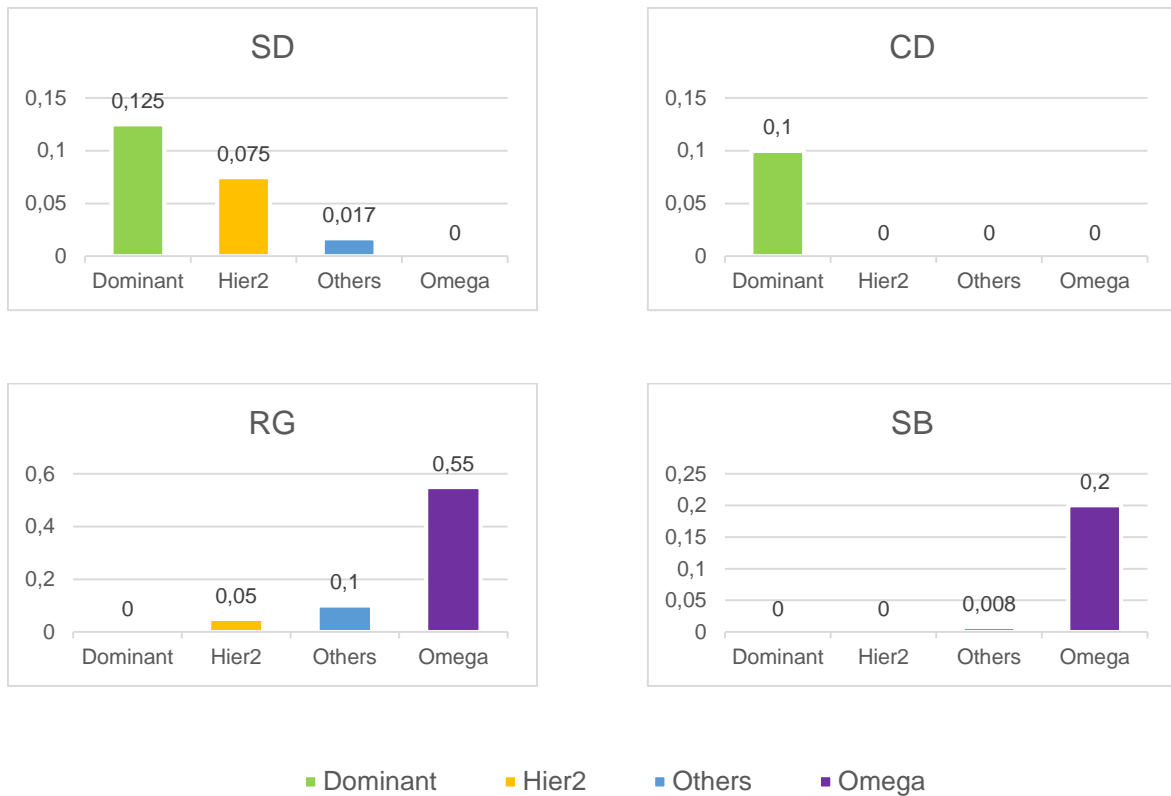


**Figure 15.** Bar chart representing the difference in the total mean durations\*, in seconds, of the various behaviors presented by children in the playground. The maximum possible value for the mean duration corresponds to the total of the sampling period per observation which is 2,5 minutes (150 seconds).

\*Because durations are proportional to frequencies, their means are proportional as well, and their distributions equal.

In turn, Figure 16 shows the distribution of the frequencies of dominance-related behaviors across the various dominance categories. The “dominant” category (subject B) exhibits the highest frequency of physical attacks (PA; 0,1 times/obs), and subtle and counter dominance displays (SD and CD; 0,125 and 0,1 times/obs, respectively); verbal attacks (VA; 0,008 times/obs), threats (TR; 0,042 times/obs) and displacements (POD; 0,025 times/obs) were most frequently perpetrated by the “others” category (subjects C, E and F); and recognition (RG; 0,55 times/obs) and submission (SB; 0,2 times/obs) behaviors were most frequently carried out by the “omega” group (subject D) (Figure 16).

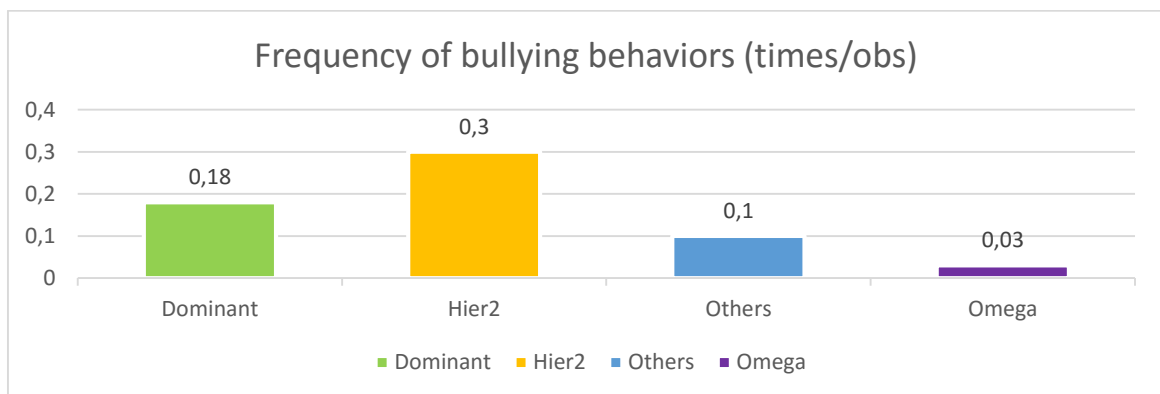




**Figure 16.** Bar charts representing the difference in the mean frequencies\* of the various behaviors presented by children in the playground across the various dominance categories. The maximum possible value for the mean frequency corresponds to the number of individual sampling points per observation which is 5.

\* Because durations are proportional to frequencies, their means are proportional as well, and their distributions equal.

So far, the results referred to all the playground situations. When considering only the bullying contexts, the results showed one category of dominance standing out from the others. The second dominant category – Hier2 (subject A) – was the category most frequently involved in bullying behaviors, with a mean value of perpetration of 0,3 times per observation (12 times in 40 observations) (Figure 17).



**Figure 17.** Bar chart representing the difference in the mean values of frequency of bullying behaviors across the various dominance categories.

## 2.2. Inferential statistics – testing of statistical hypothesis

While descriptive statistics allowed the emergence of patterns from the data, inferential statistics helped disclosure which patterns are significant and generalizable (Lund Research Ltd., 2013).

Regarding only the dominance-related behaviors, a Kruskal-Wallis test showed that there were statistically significant differences in the distribution of the frequencies and durations of SD [ $X^2(3) = 8,907$ ;  $p = 0,031$ ], CD [ $X^2(3) = 20,254$ ;  $p = 0,000$ ], RG [ $X^2(3) = 35,662$ ;  $p = 0,000$ ] and SB [ $X^2(3) = 19,823$ ,  $p = 0,000$ ] (Tables 4 and 5).

**Table 4.** Hypothesis test summary after Kruskal-Wallis analysis for both the frequencies and durations of dominance-related behaviors\*, comprising a description of the null hypothesis ( $H_0$ ), the corresponding  $p$  value and the subsequent decision. The  $p$  value considered was 0,05.

\*The prefix "D" indicates duration, whereas no prefix indicates frequency.

	$H_0$	Significance	Decision
1	The distribution of <u>PA</u> across the dominance categories is the same.	0,152	Fail to reject $H_0$ .
2	The distribution of <u>VA</u> across the dominance categories is the same.	0,801	Fail to reject $H_0$ .
3	The distribution of <u>TR</u> across the dominance categories is the same.	0,333	Fail to reject $H_0$ .
4	The distribution of <u>POD</u> across the dominance categories is the same.	0,388	Fail to reject $H_0$ .
5	The distribution of <u>SD</u> across the dominance categories is the same.	0,031	Reject $H_0$ .
6	The distribution of <u>CD</u> across the dominance categories is the same.	0,000	Reject $H_0$ .
7	The distribution of <u>RG</u> across the dominance categories is the same.	0,000	Reject $H_0$ .
8	The distribution of <u>SB</u> across the dominance categories is the same.	0,000	Reject $H_0$ .
9	The distribution of <u>DPA</u> across the dominance categories is the same.	0,152	Fail to reject $H_0$ .
10	The distribution of <u>DVA</u> across the dominance categories is the same.	0,801	Fail to reject $H_0$ .
11	The distribution of <u>DTR</u> across the dominance categories is the same.	0,333	Fail to reject $H_0$ .
12	The distribution of <u>DPOD</u> across the dominance categories is the same.	0,388	Fail to reject $H_0$ .
13	The distribution of <u>DSD</u> across the dominance categories is the same.	0,031	Reject $H_0$ .
14	The distribution of <u>DCD</u> across the dominance categories is the same.	0,000	Reject $H_0$ .

15	The distribution of <u>DRG</u> across the dominance categories is the same.	0,000	Reject Ho.
16	The distribution of <u>DSB</u> across the dominance categories is the same.	0,000	Reject Ho.

**Table 5.** Test statistics after Kruskal-Wallis analysis for those dominance-related behaviors found significant in the hypothesis test. df – degrees of freedom.

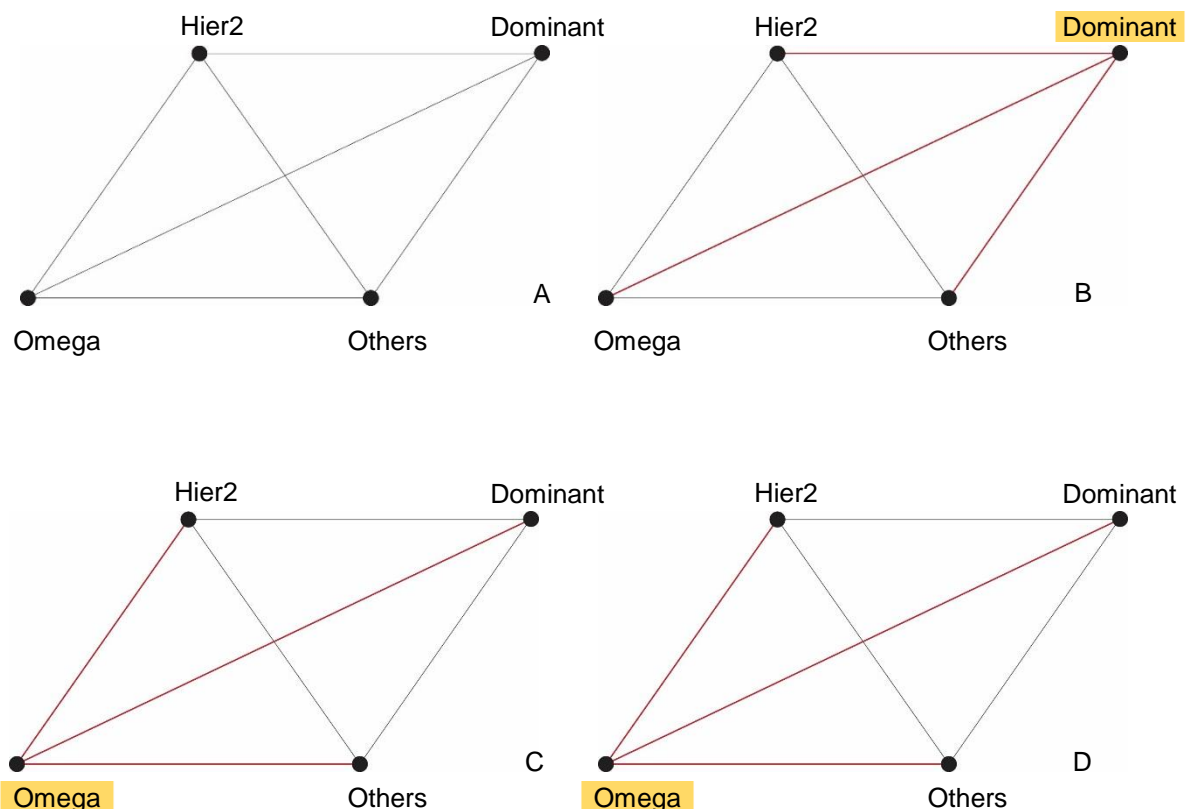
Behavioral Categories	Qui-quadrado	df	Asymptotic Significance
SD	8,907	3	0,031
DSD			
CD	20,254	3	0,000
DCD			
RG	35,662	3	0,000
DRG			
SB	19,823	3	0,000
DSB			

After identifying which dominance-related behaviors presented significant differences, we also were interested in ascertaining which pairs of dominance categories differ significantly. Post hoc tests resorting to the Dunn-Bonferroni approach were automatically performed following significant Kruskal-Wallis results and revealed the differences in the distributions of the frequencies and durations of SD, CD, RG and SB across pairs of dominance categories.

Concerning the distributions of both the frequencies and durations of subtle dominance (SD), there were not found statistically significant differences across the pairs of dominance categories. In the counter dominance category (CD), were found significant differences across the pairs Dominant-Hier2 ( $p = 0,003$ ); Dominant-Others ( $p = 0,000$ ); and Dominant-Omega ( $p = 0,003$ ). Relating to recognition behaviors (RG), the statistically significant differences were found between the pairs Dominant-Omega ( $p = 0,000$ ); Hier2-Omega ( $p = 0,000$ ); and Others-Omega ( $p = 0,000$ ). Lastly, there were found significant differences in the distributions of the frequencies and durations of submission behaviors (SB) across the Dominant-Omega ( $p = 0,002$ ); Hier2-Omega ( $p = 0,002$ ); and Others-Omega ( $p = 0,000$ ) pairs (Table 6; Figure 18).

**Table 6.** Significances of pairwise comparisons after Kruskal-Wallis analysis. Each line tests the null hypothesis that the distributions across each pair are the same. The  $p$  value considered was 0,05. Colored cells highlight the significant values.

Dominance Categories (Pairs)	Adjusted significance							
	SD	DSD	CD	DCD	RG	DRG	SB	DSB
Dominant Hier2	1,000		0,003		1,000		1,000	
Dominant Others	0,095		0,000		1,000		1,000	
Dominant Omega	0,109		0,003		0,000		0,002	
Hier2 Others	0,568		1,000		1,000		1,000	
Hier2 Omega	0,476		1,000		0,000		0,002	
Others Omega	1,000		1,000		0,000		0,000	



**Figure 18.** Graphical representations of pairwise comparisons after Kruskal-Wallis test concerning both the durations and frequencies of the significant dominance-related behaviors. Red lines represent statistical significant differences, whereas black lines correspond to non-significant differences. Yellow highlights indicate the category of dominance that stands out. A – SD and DSD; B – CD and DCD; C – RG and DRG; D – SB and DSB

The same approach was employed to the number of bullying behaviors in which the different dominance categories were involved.

In this case, the Kruskal-Wallis test showed that there were statistically significant differences in the distribution of the frequency of bullying behaviors [ $X^2(3) = 11,320$ ;  $p = 0,010$ ] among the various categories of dominance (Tables 7 and 8).

**Table 7.** Hypothesis test summary after Kruskal-Wallis analysis for the frequencies of bullying behaviors comprising a description of the null hypothesis ( $H_0$ ), the corresponding  $p$  value and the subsequent decision.  $p$  value considered was 0,05.

	$H_0$	Significance	Decision
1	The distribution of <u>number of bullying behaviors</u> across the dominance categories is the same.	0,010	Reject $H_0$ .

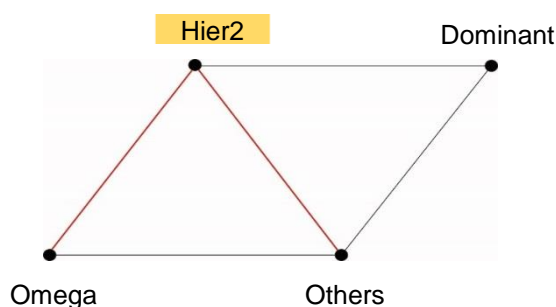
**Table 8.** Test statistics after Kruskal-Wallis analysis for the frequency of bullying behaviors. df – degrees of freedom.

Chi-square	df	Asymptotic Significance
11,320	3	0,010

Post hoc test results showed significant differences in the frequency of bullying perpetration between the pairs Hier2-Others ( $p = 0,035$ ) and Hier2-Omega (0,009) (Table 9; Figure 19).

**Table 9.** Significances of pairwise comparisons after Kruskal-Wallis analysis. Each line tests the null hypothesis that the distributions across each pair are the same. The  $p$  value considered was 0,05. Colored cells highlight the significant values.

Dominance categories (Pairs)	Adjusted significance
Dominant - Hier2	0,505
Dominant - Others	1,000
Dominant - Omega	0,864
Hier2 - Others	0,035
Hier2 - Omega	0,009
Others - Omega	1,000



**Figure 19.** Graphical representations of pairwise comparisons after Kruskal-Wallis test concerning the frequency of bullying behaviors. Red lines represent statistical significant differences, whereas black lines correspond to non-significant differences. Yellow highlights indicate the category of dominance that stands out.

# DISCUSSION

The main goals of this work were the assessment of a hierarchical organization among human adolescents; the determination of which behaviors are most frequently associated with the different ranks; and the analysis of whether or not there is a rank most frequently associated with engaging in bullying behaviors.

In order to ensure the clarity in the transmission of information, we will discuss the results obtained as answers to the research hypotheses stated in the *Objectives* chapter.

## **Groups of human adolescents display rank orderings**

The results of the pre-statistical analysis showed the existence of an almost linear hierarchical organization among the members of the identified group, whose direction and order were confirmed by the linearity and individual dominance indices, respectively. These results are in accordance with the literature, where dominance hierarchies have been found beyond the non-human species, especially in children and adolescents (Savin-Williams, 1976, 1979, 1980; Strayer & Strayer, 1976); and where vertical stratification is believed to be most likely to occur in “caged” groups and among boys (Martin, 2009; Rajecki, 1983; Savin-Williams, 1987).

## **Individuals occupying top rank positions in the hierarchy display more frequently dominance behaviors but are not necessarily the most aggressive ones**

Our results also revealed that the members of the identified hierarchy spent the majority of their free time in the playground engaged in behaviors not exclusively related to dominance/submission – behavioral category *Other*. However, statistically significant differences were found in some dominance behaviors, namely in the distributions of the frequencies and durations of counter dominance (CD) across the different hierarchical categories. The category that exhibited these behaviors significantly more was the “Dominant” one, which comprises subject B, the individual occupying the top rank in the identified hierarchy. The fact that the behavioral category significantly associated with the top rank position in the hierarchy is one of the least aggressive (either non-aggressive or non-intentionally aggressive) supports our hypothesis and is consistent with the literature (Barnard, 2004).

### **Individuals occupying bottom rank positions in the hierarchy display more frequently submissive behaviors**

Concerning the submissive behaviors – recognition (RG) and submission (SB) – there were also found statistically significant differences in their frequencies and durations distributions across the different categories of dominance, being the “Omega” category (subject D) the one that exhibited these behaviors significantly more. These results are also in accordance with the hypothesis listed and with the literature reviewed. In fact, as Barnard (2004) stated, “dominance is not equivalent to aggressiveness (...) what matters is that dominants tend to ‘win’ encounters, even though this may be due to passive, sometimes barely discernible, deference by lower rankers”.

### **The frequency of perpetrating bullying behaviors is higher in individuals aiming at the top rank position in a hierarchy, thus being the most aggressive ones**

During all 40 observations, every markedly intentional aggressive act occurring in a clear imbalance of power was accounted per individual and, based on it, the mean frequencies of bullying perpetration per subject per observation were calculated. The results indicated statistically significant differences in the distribution of the frequencies of bullying perpetration across the categories of dominance. The category most frequently engaged in bullying behaviors was the “second dominant” one, which comprises the second rank individual in the hierarchy, subject A. A pairwise comparison allowed to see that subject A was statistically more involved in bullying than the “Others” (subjects C, E and F) and “Omega” (subject D) categories but this difference was not statistically significant when compared with the subject B (Dominant category), the top rank individual in the hierarchy.

Together, these results support our hypothesis that bullying may be a non-prosocial, aggressive attempt to achieve dominance within a group, being congruent with those found in the literature (Barnard, 2004; Caravita & Cillessen, 2012; Pellegrini, 1998; Reijntjes et al., 2013; Savin-Williams, 1987).

# CONCLUSIONS

School bullying has traditionally been studied resorting to indirect measures such as surveys and questionnaires, and only few studies have employed ethological methods in their designs. In actual fact, no ethological-based bullying study was found in the literature concerning the Portuguese population. In view of the previously mentioned, this work approached the bullying phenomenon in school context through ethological methods and concepts.

The results of this work clearly indicate that human adolescents, like many other non-human social species, aggregate into hierarchical organized groups, which may have implications on the behaviors each rank order displays. As expected, the statistically significant differences were found in the perpetration of both dominant (non-aggressive/non-intentionally aggressive) and submissive behaviors (most frequently exhibited by the top and low rank individuals, respectively). Moreover, and also as expected, the group element that were most frequently engaged in bullying behaviors was the one occupying the second rank in the hierarchy, suggesting that involvement in intentional, power imbalanced (and commonly repeated) aggression may be a non-prosocial way of pursuing dominance.

However, this study faced some limitations both in its design and execution. In the first place, the relative short time for the development and application of the project restricted the conditions under which it could be undertaken. Secondly, and so that the reactivity levels of the subject regarding the observer were maintained as low as possible, the perception of some categories of behavior might have been conditioned, when compared to others. As an example, the low frequencies/durations recorded for the verbal attacks and threats may have been due to distance the observer had to keep in relation to the observed. Furthermore, at some point during the observations, the play objects available (such as ping-pong tables and paddles) were inaccessible, which may also have conditioned the frequencies/durations of displacement behaviors. Other limitations of the current study relate to the small sample size and constitution (only 6 male individuals of just one school).

Having all the above mentioned in consideration, future investigation in the subject and resorting to the same methods should comprise more schools from all around the country, more and more diverse groups (either in gender, age, ethnicity or social class), and more effective and efficient observation techniques, such as audiovisual recording.

Nevertheless, the current study must be regarded as an important first step for a more comprehensive understanding and more effective prevention of the bullying phenomenon in Portugal.

# REFERENCES

- Alcock, J. (2001). *Animal Behavior: An Evolutionary Approach* (7th ed.). Massachusetts, USA: Sinauer Associates, Inc.
- Altmann, J. (1974). Observational study of behavior: sampling methods. *Behaviour*, *49*, 227-265.
- Aluede, O., Adeleke, F., Omoike, D., & Afen-Akpaida, J. (2008). A review of the extent, nature, characteristics and effects of Bullying behaviour in schools. *Journal of Instructional Psychology*, *35*(2), 151-158.
- Archer, J. (1995). What can ethology offer the psychological study of human aggression? *Aggressive Behavior*, *21*, 243-255.
- Archer, J. (2001). A strategic approach to aggression. *Social Development*, *10*(2), 267-271.
- Arseneault, L., Bowes, L., & Shakoor, S. (2010). Bullying victimization in youths and mental health problems: "Much ado about nothing"? *Psychological Medicine*, *40*, 717-729.
- Atlas, R., & Pepler, D. (1998). Observations of bullying in the classroom. *The Journal of Educational Research*, *92*(2), 86-99.
- Barnard, C. J. (2004). *Animal Behavior: mechanism, development, function and evolution*. Essex, England: Pearson Education Limited.
- Barrett, L., & Stulp, G. (2013). Four more reasons why ethology matters: Tinbergen and the human sciences. *Human Ethology Bulletin: Special Issue on Tinbergen*, *28*(4), 39-49.
- Bauman, S., Toomey, R. B., & Walker, J. L. (2013). Associations among bullying, cyberbullying, and suicide in high school students. *Journal of Adolescence*, *36*, 341-350.
- Benenson, J. F. (2009). Sex Differences in Aggression From an Adaptive Perspective. In M. J. Harris (Ed.), *Bullying, Rejection, and Peer Victimization* (pp. 171-198). New York: Springer.
- Berdicio, S., & Nash, L. T. (2009, 2011). Chimpanzee 8. Retrieved 17/11/2014, from <http://www.ethosearch.org/research/ethogram/112/functional>
- Berger, K. S. (2007). Update on Bullying at School: Science Forgotten? *Developmental Review*, *27*, 90-126.
- Book, A. S., Volk, A. A., & Hosker, A. (2012). Adolescent bullying and personality: an adaptive approach. *Personality and Individual Differences*, *52*, 218-223.
- Calafate, L. C. (1996). Etologia da Criança: Uma Perspectiva Descritiva do Comportamento do Homem. *Saber Educar*, *1*, 69-84.
- Caravita, S. C. S., & Cillessen, A. H. N. (2012). Agentic or Communal? Associations between interpersonal goals, popularity, and bullying in middle childhood and early adolescence. *Social Development*, *21*(2), 376-395.
- Cook, C. R., Williams, K. R., Guerra, N. G., Kim, T. E., & Sadek, S. (2010). Predictors of bullying and victimization in childhood and adolescence: a meta-analytic investigation. *School Psychology Quarterly*, *25*(2), 65-83.
- Cosnier, J. (1986). Ethology: a transdisciplinary discipline. In J. L. Camus & J. Cosnier (Eds.), *Ethology and psychology* (pp. 19-28). Toulouse: Privat, I.E.C.
- Costa, P., & Pereira, B. (2010). *O bullying na escola: a prevalência e o sucesso escolar*. Paper presented at the I Seminário Internacional "Contributos da Psicologia em Contextos Educativos", Braga: Instituto de Educação da Universidade do Minho.
- Craig, W. M., & Pepler, D. (1995). Peer processes in bullying and victimization: an observational study. *Exceptionality Education Canada*, *5*(3&4), 81-95.
- Craig, W. M., Pepler, D., & Atlas, R. (2000). Observations of bullying in the playground and in the classroom. *School Psychology International*, *21*, 22-36.
- Dake, J. A., Price, J. H., & Telljohann, S. K. (2003). The nature and extent of bullying at school. *Journal of School Health*, *73*(5), 173-180.
- Dobzhansky, T. (1964). Biology, Molecular and Organismic. *American Zoologist*, *4*, 443-452.
- Doğruer, N., & Yaratana, H. (2014). Developing a bullying scale for use with university students. *Social Behavior and Personality*, *42*(Suppl.), S81-S92.

- Dugatkin, L. A. (2014). *Principles of Animal Behavior* (3rd ed.). New York, USA: W. W. Norton & Company, Inc.
- Eibl-Eibesfeldt, I. (1977). The biological unity of mankind: human ethology, concepts and implications. *Prospects: quarterly review of education*, VII(2), 163-183.
- Eibl-Eibesfeldt, I. (1997). Human Ethology: Origins and Prospects of a New Discipline. In K. Atzwanger, K. Grammer, K. Schäfer & A. Schmitt (Eds.), *New Aspects of Human Ethology*. New York: Plenum Press.
- Evans, C. B. R., Fraser, M. W., & Cotter, K. L. (2014). The effectiveness of school-based bullying prevention programs: A systematic review. *Aggression and Violent Behavior*, 19, 532-544.
- Farrington, D. P., & Ttofi, M. M. (2009). *School-based programs to reduce bullying and victimization*. Campbell Systematic Reviews, (6).
- Fox, R., & Fleising, U. (1976). Human Ethology. *Annual Review of Anthropology*, 5, 265-288.
- Frisén, A., Hasselblad, T., & Holmqvist, K. (2012). What actually makes bullying stop? Reports from former victims. *Journal of Adolescence*, 35, 981-990.
- Gallup, G. G., & Suarez, S. D. (1983). Overcoming Our Resistance to Animal Research: Man in Comparative Perspective. In D. W. Rajecki (Ed.), *Comparing Behavior: Studying Man Studying Animals*. New Jersey: Lawrence Erlbaum Associates, Inc.
- Garandeau, C. F., & Cillessen, A. H. N. (2006). From indirect aggression to invisible aggression: A conceptual view on bullying and peer group manipulation. *Aggression and Violent Behavior*, 11, 612-625.
- García, A. I. S., & Margallo, E. M. (2014). Bullying: What's going on? A bibliographic review of last twelve months. *Procedia - Social and Behavioral Sciences*, 132, 269-276.
- Gat, A. (2010). Why war? Motivations for Fighting in the Human State of Nature. In P. M. Kappeler & J. B. Silk (Eds.), *Mind the Gap - Tracing the Origins of Human Universals* (pp. 197-220). Verlag; Berlin; Heidelberg: Springer.
- Hawley, P. H. (1999). The ontogenesis of social dominance: a strategy-based evolutionary perspective. *Developmental Review*, 19, 97-132.
- Hepburn, L., Azrael, D., Molnar, B., & Miller, M. (2012). Bullying and suicidal behaviors among urban high school youth. *Journal of Adolescent Health*, 51, 93-95.
- Hinduja, S., & Patchin, J. W. (2010). Bullying, cyberbullying, and suicide. *Archives of Suicide Research*, 14(3), 206-221.
- Horton, P. (2011). School bullying and social and moral orders. *Children & Society*, 25, 268-277.
- IBM Corp. (2015). IBM SPSS Statistics for Windows (Version 23.0). Armonk, NY: IBM Corp.
- Instituto Nacional de Estatística. (2012). Censos 2011 Resultados Definitivos - Região Norte. Lisboa, Portugal.
- Jiang, D., Walsh, M., & Augimeri, L. K. (2011). The linkage between childhood bullying behaviour and future offending. *Criminal Justice and Behavior*, 21, 128-135.
- Jones, N. B. (1972). Characteristics of Ethological Studies of Human Behaviour. In N. B. Jones (Ed.), *Ethological Studies of Child Behaviour*. Cambridge: Cambridge University Press.
- Juvonen, J., & Galván, A. (2009). Bullying as a Means to Foster Compliance. In M. J. Harris (Ed.), *Bullying, Rejection, and Peer Victimization* (pp. 299-318). New York: Springer.
- Kim, M. J., Catalano, R. F., Haggerty, K. P., & Abbott, R. D. (2011). Bullying at elementary school and problem behaviour in young adulthood: A study of bullying, violence and substance use from age 11 to 21. *Criminal Behaviour and Mental Health*, 21, 136-144.
- Klein, Z. (2000). The Ethological Approach to the Study of Human Behavior. *Neuroendocrinology Letters*, 21, 477-481.
- Klomek, A. B., Sourander, A., Kumpulainen, K., Piha, J., Tamminen, T., Moilanen, I., . . . Gould, M. S. (2008). Childhood bullying as a risk for later depression and suicidal ideation among Finnish males. *Journal of Affective Disorders*, 109, 47-55.
- Lehner, P. N. (1996). *Handbook of Ethological Methods* (2nd ed.). United Kingdom: Cambridge University Press.

- Liang, H., Flisher, A. J., & Lombard, C. J. (2007). Bullying, violence, and risk behavior in South African school students. *Child Abuse & Neglect*, 31, 161-171.
- Lisboa, C., Braga, L. d. L., & Ebert, G. (2009). O fenómeno buyyling ou vitimização entre pares na atualidade: definições, formas de manifestação e possibilidades de intervenção. *Contextos Clínicos*, 2(1), 59-71.
- Lorenz, K. (1963). *On Aggression* (2005 ed.). London: Taylor and Francis e-Library.
- Lund Research Ltd. (2013). Laerd Statistics - Descriptive and Inferential Statistics. Retrieved 27-06-2015, from <https://statistics.laerd.com/statistical-guides/descriptive-inferential-statistics.php>
- Martin, J. L. (2009). Formation and stabilization of vertical hierarchies among adolescents: towards a quantitative ethology of dominance among humans. *Social Psychology Quarterly*, 72(3), 241-264.
- Matos, M. G. d., & Gonçalves, S. P. (2009). Bullying nas escolas: comportamentos e percepções. *Psicologia, Saúde e Doenças*, 10(1), 3-15.
- Matos, M. G. d., Simões, C., Camacho, I., Reis, M., & Equipa do Projecto Aventura Social. (2014). A Saúde dos Adolescentes Portugueses - Relatório do Estudo HBSC 2014 *Health Behaviour in School-Aged Children*: World Health Organization, Direção Geral de Saúde, Projecto Aventura Social.
- Matos, M. G. d., Simões, C., Gaspar, T., & Equipa do Projecto Aventura Social. (2009). Violência ente pares no contexto escolar em Portugal, nos últimos 10 anos. *Interações*, 13, 98-124.
- McGrew, W. C. (2004). *The Cultured Chimpanzee: Reflections on Cultural Primatology*. Cambridge, United Kingdom: Cambridge University Press.
- Melim, M., & Pereira, B. (2012). *Bullying escolar: Os padrões de agressão*. Paper presented at the II Seminário Internacional "Contributos da Psicologia em Contextos Educativos", Braga: Instituto de Educação da Universidade do Minho.
- Michel, G. F., & Moore, C. L. (1995). *Animal Behavior, Ethology, and Human Development Developmental Psychobiology: An Interdisciplinary Science*. Cambridge, Massachusetts: The MIT Press.
- Moreno, C. B., & Muñoz-Delgado, J. (2007). An account on the history of ethology. *Suma Psicológica*, 14(2), 213-224.
- Morris, D. (1967). *The Naked Ape*. Canada: Bantam Books of Canada Ltd.
- Nickerson, A. B., & Melle-Taylor, D. (2014). Empathetic responsiveness, group norms, and prosocial affiliations in bullying roles. *Social Psychology Quarterly*, 29(1), 99-109.
- Novo, M., Seijo, D., Vilariño, M., & Vázquez, M. J. (2013). Frecuencia e intensidad en el acoso escolar: ¿Qué es qué en la victimización? *Revista Iberoamericana de Psicología y Salud*, 4(2), 1-15.
- O'Connell, P., Pepler, D., & Craig, W. (1999). Peer involvement in bullying: insights and challenges. *Journal of Adolescence*, 22, 437-452.
- Olthof, T., Goossens, F. A., Vermande, M. M., Aleva, E. A., & Meulen, M. v. d. (2011). Bullying as strategic behavior: Relations with desired and acquired dominance in the peer group. *Journal of School Psychology*, 49, 339-359.
- Olweus, D. (2011). Bullying at school and later criminality: Findings from three Swedish community samples of males. *Criminal Behaviour and Mental Health*, 21, 151-156.
- Olweus, D. (2013). School Bullying: Development and Some Important Challenges. *Annual Review of Clinical Psychology*, 9, 751-780.
- Pellegrini, A. D. (1998). Bullies and victims in school: a review and call for research. *Journal of Applied Developmental Psychology*, 19(2), 165-176.
- Pellegrini, A. D. (2002). Affiliative and aggressive dimensions of dominance and possible functions during early adolescence. *Aggression and Violent Behavior*, 7, 21-31.
- Pellegrini, A. D., & Bartini, M. (2001). Dominance in early adolescent boys: affiliative and aggressive dimensions and possible functions. *Merrill-Palmer Quarterly*, 47(1), 142-163.

- Pepler, D., & Craig, W. M. (1995). A peek behind the fence: naturalistic observations of aggressive children with remote audiovisual recording. *Developmental Psychology, 31*(4), 548-559.
- Pereira, B., Mendonça, D., Neto, C., Valente, L., & Smith, P. K. (2004). Bullying in Portuguese Schools. *School Psychology International, 25*(2), 241-254.
- Potegal, M. (1979). The reinforcing value of several types of aggressive behavior: a review. *Aggressive Behavior, 5*, 353-373.
- Primate Foundation of Arizona. (2009, 2011). Chimpanzee 6. Retrieved 17/11/2014, from <http://www.ethosearch.org/research/ethogram/92/functional>
- Rajecki, D. W. (1983). Successful Comparative Psychology: Four Case Histories. In D. W. Rajecki (Ed.), *Comparing Behavior: Studying Man Studying Animals*. New Jersey: Lawrence Erlbaum Associates, Inc.
- Rayner, C., & Hoel, H. (1997). A summary review of literature relating to workplace bullying. *Journal of Community & Applied Social Psychology, 7*, 181-191.
- Reijntjes, A., Vermande, M. M., Goossens, F. A., Olthof, T., van de Schoot, R., Aleva, L., & van der Meulen, M. (2013). Developmental trajectories of bullying and social dominance in youth. *Child Abuse & Neglect, 37*, 224-234.
- Richards, M. P. M., & Bernal, J. F. (1972). An Ethological Study of Mother-Infant Interactions. In N. B. Jones (Ed.), *Ethological Studies of Child Behaviour*. Cambridge: Cambridge University Press.
- Rigby, K. (2002). *New Perspectives on Bullying*. London: Jessica Kingsley Publishers.
- Rigby, K. (2003). *Stop the Bullying - A Handbook for Schools* (2nd ed.). Melbourne: Acer Press.
- Rigby, K. (2004). Addressing Bullying in Schools: Theoretical Perspectives and their Implications. *School Psychology International, 25*(3), 287-300.
- Salmivalli, C. (2010). Bullying and the peer group: a review. *Aggression and Violent Behavior, 15*, 112-120.
- Salmivalli, C., Lagerspetz, K., Björkqvist, K., Österman, K., & Kaukiainen, A. (1996). Bullying as a group process: participant roles and their relations to social status within the group. *Aggressive Behavior, 22*, 1-15.
- Savin-Williams, R. C. (1976). An ethological study of dominance formation and maintenance in a group of human adolescents. *Child Development, 47*, 972-979.
- Savin-Williams, R. C. (1979). Dominance hierarchies in groups of early adolescents. *Child Development, 50*(4), 923-934.
- Savin-Williams, R. C. (1980). Dominance hierarchies in groups of middle to late adolescent males. *Journal of Youth and Adolescence, 9*(1), 75-85.
- Savin-Williams, R. C. (1987). *Adolescence: An Ethological Perspective*. New York: Springer Science + Business Media
- Shaw, T., Dooley, J. J., Cross, D., Zubrick, S. R., & Waters, S. (2013). The forms of bullying scale (FBS): validity and reliability estimates for a measure of bullying victimization and perpetration in adolescence. *Psychological Assessment, 25*(4), 1045-1057.
- Simplicio, J. S. C. (2013). How to effectively use positive character attributes exhibited by bullies to change negative behaviors. *Journal of Instructional Psychology, 40*(1), 27-31.
- Smith, P. K., & Brain, P. (2000). Bullying in Schools: Lessons from two decades of research. *Aggressive Behavior, 26*, 1-9.
- Smith, P. K., Madsen, K. C., & Moody, J. C. (1999). What causes the age decline in reports of being bullied at school? Towards a developmental analysis of risks of being bullied. *Educational Research, 41*(3), 267-285.
- Strayer, F. F., & Strayer, J. (1976). An ethological analysis of social agonism and dominance relations among preschool children. *Child Development, 47*(4), 980-989.
- Strøm, I. F., Thoresen, S., Wentzel-Larsen, T., & Dyb, G. (2013). Violence, bullying and academic achievement: A study of 15-year-old adolescents and their school environment. *Child Abuse & Neglect, 37*, 243-251.

- Sutton, J., & Smith, P. K. (1999). Bullying as a group process: an adaptation of the participant role approach. *Aggressive Behavior, 25*, 97-111.
- Tharp-Taylor, S., Haviland, A., & D'Amico, E. J. (2009). Victimization from mental and physical bullying and substance use in early adolescence. *Addictive Behaviors, 34*, 561-567.
- Tinbergen, N. (1963). On aims and methods of ethology. *Zeitschrift für Tierpsychologie, 20*, 410-433.
- Tinbergen, N. (1972). *Functional Ethology and the Human Sciences*. Paper presented at the The Croonian Lecture.
- Ttofi, M. M., & Farrington, D. P. (2009). What works in preventing bullying: effective elements of anti-bullying programmes. *Journal of Aggression, Conflict and Peace Research, 1*(1), 13-24.
- Ttofi, M. M., & Farrington, D. P. (2011). Effectiveness of school-based programs to reduce bullying: a systematic and meta-analytic review. *Journal of Experimental Criminology, 7*, 27-56.
- UNICEF. (2014). Hidden in plain sight: a statistical analysis of violence against children. New York: United Nations Children's Fund.
- United Nations. The Universal Declaration of Human Rights. Retrieved 06-02-2015, from <http://www.un.org/en/documents/udhr/index.shtml>
- van Dierendonck, M. C., de Vries, H., & Schilder, M. B. H. (1995). An Analysis of Dominance, Its Behavioural Parameters and Possible Determinants in a Herd of Icelandic Horses in Captivity. *Netherlands Journal of Zoology, 45*(3-4), 362-385.
- Vieira, A. B. (1989). Fundamentos gerais da Etologia. *Análise Psicológica, 1-2-3*(VII), 23-31.
- Volk, A. A., Camilleri, J. A., Dane, A. V., & Marini, Z. A. (2012). Is adolescent bullying an evolutionary adaptation? *Aggressive Behavior, 38*, 222-238.
- Vreeman, R. C., & Carroll, A. E. (2007). A systematic review of school-based interventions to prevent bullying. *Archives of Pediatrics and Adolescent Medicine, 161*, 78-88.
- Wang, J., Iannotti, R. J., Luk, J. W., & Nansel, T. R. (2010). Co-occurrence of victimization from five subtypes of bullying: physical, social exclusion, spreading rumors, and cyber. *Journal of Pediatric Psychology, 35*(10), 1103-1112.
- Washburn, S. L., & Dolhinow, P. C. (1983). Comparison of Human Behaviors. In D. W. Rajecki (Ed.), *Comparing Behavior: Studying Man Studying Animals*. New Jersey: Lawrence Erlbaum Associates, Inc.
- Watts, D. P. (2010). Dominance, Power, and Politics in Nonhuman and Human Primates. In P. M. Kappeler & J. B. Silk (Eds.), *Mind the Gap - Tracing the Origins of Human Universals* (pp. 109-138). Verlag; Berlin; Heidelberg: Springer.
- Weisfeld, C. C., & Weisfeld, G. E. (2013). Defining normal on the playground: what would Tinbergen do? *Human Ethology Bulletin, 28*(4), 12-22.
- Wong, J. S., & Schonlau, M. (2013). Does bully victimization predict future delinquency? A propensity score matching approach. *Criminal Justice and Behavior, 40*(11), 1184-1208.
- Zivin, G. (1983). Hybrid Models: Modifications in Models of Social Behavior That Are Borrowed Across Species and Up Evolutionary Grades. In D. W. Rajecki (Ed.), *Comparing Behavior: Studying Man Studying Animals*. New Jersey: Lawrence Erlbaum Associates, Inc.

# APPENDICES

**Appendix A.** Examples of typically considered human behaviors exhibited by non-human species. From: Gallup and Suarez (1983, p. 13)

<i>Source</i>	<i>Phenomenon</i>	<i>Animal</i>	<i>Situation</i>	<i>Behavior</i>
Davenport & Rogers, 1970	Cross-modal perception	Chimpanzee	Laboratory	Subjects were able to match-to-sample across the visual and tactile modalities
Fisher, 1939	Tool use	Sea otter	Naturalistic observation	Hammer small mollusks against a rock resting on the chest
Gallup, 1970	Self-awareness	Chimpanzee	Laboratory	Subjects made explicit reference to their mirror image in terms of grooming, auto stimulation, and responses to superimposed body marks with the aid of a mirror
Gallup, 1982	Consciousness	Chimpanzee	Laboratory	Capacity to become the object of one's own attention as evidenced by self-recognition
Gallup, 1982	Mind	Chimpanzee	Laboratory	Ability to monitor one's own attention as evidenced by the attribution of mental states to other organisms
Goodall, Bandora, Bergmann, Busse, Matama, Mpongo, Pierce, & Riss, 1979	Murder	Chimpanzee	Naturalistic observation	Brutal lone attacks that resulted in death; killing infants
Harlow & Suomi, 1971	Mental illness	Rhesus monkey	Laboratory	Depression, self-mutilation, and stereotypy induced by social isolation
Hernstein, 1966	Religion	Pigeon	Laboratory	Stereotyped, highly ritualized responding that lacks an instrumental component and occurs under conditions in which the receipt of reward bears no relationship to responding
Itani & Nashimura, 1973	Culture	Japanese macaque	Naturalistic observation	Cross-generational transmission of food preparation behaviors (washing sweet potatoes to remove dirt; separating wheat from sand by immersion in water)
Kölher, 1927	Insight	Chimpanzee	Laboratory	Sudden solutions following periods of ineffectual problem solving (fitting sticks together to obtain food that was out of reach)
Kummer, 1968	Politics	Baboon	Naturalistic observation	Formation of coalitions during agonistic encounters
Lethmate & Dücker, 1973	Adornment behavior	Orangutan	Laboratory	Subjects adorned their bodies with objects (wearing a piece of lettuce like a hat) and examined the effect in a mirror
Menzel, 1972	Cooperation	Chimpanzee	Captivity	Cooperative ladder building and support
Menzel, 1979	Extrapolation	Chimpanzee	Captivity	Subjects not knowing the placement of hidden food could extrapolate its location on the basis of an informed chimpanzee's posture and initial movements
Morris, 1962	Art	Chimpanzee	Captivity	Painting and finger painting
Premack, 1971	Displacement and representation	Chimpanzee	Laboratory	Capacity to abstract and symbolize objects in their absence (using a blue triangle to represent an apple)
Premack, 1971	Quantification	Chimpanzee	Laboratory	Learned to use appropriately symbols for "all", "none", "one" and "several"
Silk, 1979	Reciprocal altruism	Chimpanzee	Laboratory	Reciprocal food sharing
Teleki, 1973a	Reactions to death	Chimpanzee	Naturalistic observation	Agitated and peculiar responses following the accidental death of a group member
Teleki, 1973b	Hunting	Chimpanzee	Naturalistic observation	Systematic, male-oriented, cooperative hunting patterns that terminate in sharing
Thompson & Hermann, 1977	Memory processes	Porpoise	Laboratory	Memory span and performance on probe recognition tasks that was highly similar to humans

van Lawick-Goodall, 1968	Attribution	Chimpanzee	Naturalistic observation	The mother of an infant injured while playing with another will attack the aggressor's mother
van Lawick-Goodall, 1968	Incest avoidance	Chimpanzee	Naturalistic observation	Avoidance of mother-son and sister-brother mating
van Lawick-Goodall, 1968	Politics	Chimpanzee	Naturalistic observation	Formation of stable dominance hierarchies based in part on psychological tactics
van Lawick-Goodall, 1968	Tool fabrication	Chimpanzee	Naturalistic observation	Preparation of twigs to fish for termites; use of crushed leaves as a sponge to obtain drinking water, as a means for extracting brains from prey, or as an aid to grooming
van Lawick-Goodall, 1971	Invention	Chimpanzee	Naturalistic observation	Banging kerosene cans together to augment an intimidation display by a low-ranking male who subsequently rose to alpha status
Woodruff & Premack, 1979	Deception	Chimpanzee	Laboratory	Intentionally withheld information, or provided misinformation to humans as to the location of a piece of favored food

**Appendix B. Observation data sheet resorted to in phase B**

Observation no.:

Time:

Location:

Date:

Instantaneous sampling of the subjects' behavior.

Subject	Sampling Period	Sampling Points	Behavioral category								
			PA	VA	TR	POD	SD	CD	RG	SB	Other
A	10h00'00" - 10h02'30"	30"									
		60"									
		90"									
		120"									
		150"									
B	10h02'30" - 10h05'00"	30"									
		60"									
		90"									
		120"									
		150"									
C	10h05'00" - 10h07'30"	30"									
		60"									
		90"									
		120"									
		150"									
D	10h07'30" - 10h10'00"	30"									
		60"									
		90"									
		120"									
		150"									
E	10h10'00" - 10h12'30"	30"									
		60"									
		90"									
		120"									
		150"									
F	10h12'30" - 10h15'00"	30"									
		60"									
		90"									
		120"									
		150"									

Dyadic interaction matrix.

Supplanter	Supplantee											
A												
B												
C												
D												
E												
F												

Frequency of bullying behaviors.

Subject	Number of occurrences (bullying behavior) (intra and inter-group)
A	
B	
C	
D	
E	
F	

## Appendix C. School authorization for the conduction of the study



Agrupamento de Escolas João da Silva Correia  
EB2.3

### DECLARAÇÃO

Para os devidos efeitos, declaro que a Margarida Monteiro da Costa Carvalho Ferreira, encontra-se autorizada a realizar estágio curricular e desenvolvimento de pesquisa para efeitos de realização de mestrado neste estabelecimento de ensino entre os meses de novembro e abril de 2014.

São João da Madeira, 12 de novembro de 2014



**Appendix D.** Written approval from the Ethics Committee of the Institute of Biomedical Sciences Abel Salazar of University of Porto – ICBAS-UP for the implementation of the study



**Parecer da Comissão de Ética do ICBAS-UP**

**PROJETO Nº 084/2014**

**Título:** *Perspetiva etológica no estudo do Bullying*

**Investigador Responsável:** Liliana de Sousa

**Outros Investigadores:** Margarida Carvalho Ferreira

**Orientadora do Mestrado em Medicina Legal do ICBAS-UP:** Liliana de Sousa

**Duração do Projeto:** até maio de 2015

A Comissão de Ética do ICBAS-UP reuniu dia 28 de abril de 2015 no edifício do ICBAS - Sala de reuniões do Departamento de Ciências do Comportamento, na presença de Manuel Vilanova, Margarida Araújo, Maria Antónia Gonçalves, Paula Faria e Paulo Maia. Decidiu emitir parecer favorável à realização do projeto supracitado, por unanimidade.

Com os melhores cumprimentos,

Pela Comissão de Ética do ICBAS-UP,

Prof. Doutora Liliana de Sousa (presidente)

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*The above project is in accordance with the Portuguese law and the ICBAS-UP Ethics Committee criteria.*

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