

Social anxiety in modern societies from an evolutionary perspective

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Abstract

This study seeks to frame the evolutionary roots of why people strive for attractiveness, and how seeking social status and the desire to be accepted by peers in today's society may cause psychological distress and social anxiety. The central aim of the present study is twofold. First, the goal is to break down biological selection into its component parts to understand the evolution of key human traits that consequently make social status concerns and social anxiousness reasonable and adaptive. The second goal is to highlight the socioeconomic conditions that may enhance people's propensity to develop social anxiety. This study proposes that an evolutionary approach to social anxiety should rely on a broad concept of social selection (grouped into nonsexual social selection, intersexual selection, and intrasexual selection). Furthermore, the overwhelming visualisation of differences in quality and conspicuous displays of status markers in modern societies may act as psychological stressors that increase people's propensity to develop social anxiety. Understanding how the evolved human mind and behavioural strategies respond to socioeconomic and sociocultural circumstances is relevant both in the formation of public policy and in clinical health services aiming to benefit public health.

Keywords Social anxiety · Social status · Social comparison · Status signalling · Socio-economic environment · Evolutionary selection mechanisms · Evolutionary psychology

1 Introduction

Among all disease groups worldwide, mental disorders are the leading cause of years lived with disability [1], and this results in tremendous economic costs [2]. An apparent rise in mental health issues, including social anxiety, especially among young people in many Western countries, [3–6] has been linked to societal changes such as rising material and non-material inequalities, [7, 8] changes in family consultations and dynamics, [9] increasing social media use [10, 11], and academic and social pressures [12]. The concern of secular trends in adolescent mental health emphasises the need for ultimate causal explanations where genetic inheritance and environmental factors are integrated [13]. In this context, an biological evolutionary understanding of humans striving for social status and attractiveness and our inherent need to be liked by others, could be useful in predicting which certain socioeconomic and sociocultural conditions increase the risk of psychological distress and social anxiety [14, 15]. From an evolutionary perspective, human behaviour is organized around the biological goals of survival and reproduction. Social events that interfere with the achievement of biological goals may constitute a stressor that impacts mental health and well-being [16]. Selection mechanisms of human traits maximize reproduction—not health [13]. The evolutionary explanation for fears of certain situations is (often) based on an understanding that contemporary human beings are descendants of ancestors who were able to avoid the life-threatening situations that arose because it provided them better survival [17]. Thus, a sensible rationale behind being

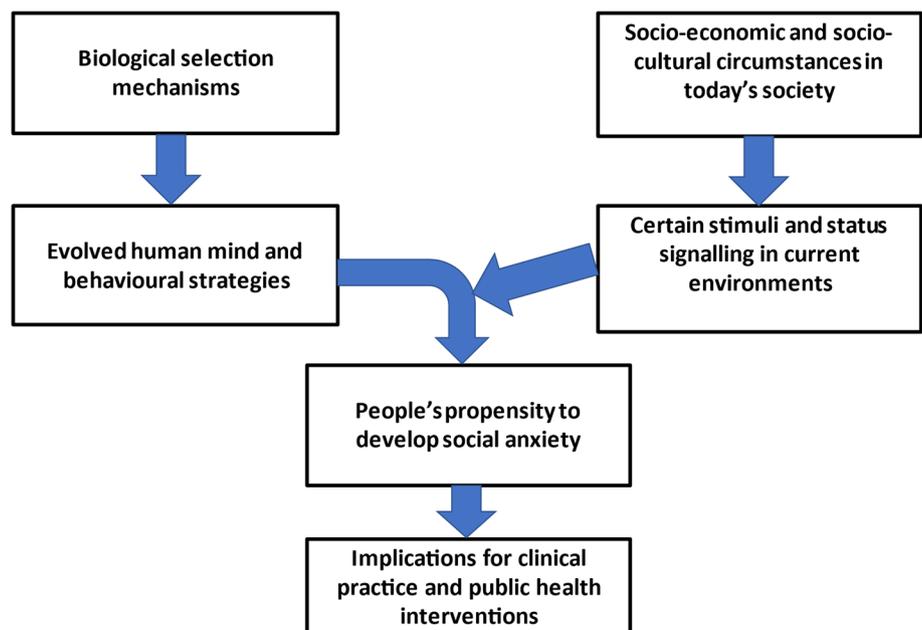
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wary of poisonous creatures is the reduction of the risk of physical injuries and infection by transmittable diseases [18]. Likewise, many adaptive approaches of people’s fear about behaving in a way that will be humiliating or embarrassing in social gatherings and performance situations, which ultimately leads to social anxiety/phobia [19], are based on natural selection. However, trait social anxiety lacks an equally obvious evolutionary explanation as the psychological reactions that can occur when we are facing life-threatening situations such as with dangerous animals. The self-presentation model of social anxiety, where social anxiety serves as an early warning system [20], has proposed that social anxiety is an adaption due to the advantage of the ability to quickly identify and respond to social threats. Karasewich and Kuhlmeier [21] outline in their review three existing evolutionary approaches—stated as threat-detection, social competition, and social exclusion—with the common overarching hypothesis that social anxiety evolved as a mechanism for avoiding the social threats that arose from living in larger groups. These theories emphasize that social anxiety is a direct consequence of natural selection, or that such a type of social behaviour may have been beneficial regarding increased survival among our genetic ancestors. The present study aims to add a nuanced picture of these evolutionary adoption theories which, rather than natural selection in the general sense, rely on specific types of selection forces that appear to be relevant in the evolution of social anxiety. Furthermore, this study will highlight the link between the socioeconomic environment and the occurrence of social anxiety in a certain population.

This study used a multidisciplinary approach based on a review of up-to-date theoretical research from evolutionary biology, psychology, social epidemiology and public health, as well as Darwin’s book *The Descent of Man, and Selection in Relation to Sex* [22]. English written articles were identified via literature searches using PubMed and Google Scholars as well as the reference lists of relevant articles, and no restriction on the earliest date of publication were made. A review of the existing literature was performed in two steps. The first step of review is motivated by the pursuit of the ‘evolutionary root’ of social anxiety. This review was preselected based on biological selection forces and human traits: social rank behaviour, competitive behaviour, status signalling, social comparison, collaboration and mate choice. The second step of review was preselected based on studies related to the socio-economic and socio-cultural environment, and mental health. Next, the author aimed to integrate information identified and perceived as relevant from articles included in the literature review. Based on this non-systematic but explorative review, the study postulates some assumptions and predictions about social anxiety from an evolutionary perspective. The reviews are grounded on two assumptions: (i) social anxiousness has an adaptive function from an evolutionary point of view, and (ii) the socioeconomic environment is associated with the occurrence of social anxiety in modern societies. A brief conceptual framework for this study is illustrated in Fig. 1.

Fig. 1 A conceptual framework of social anxiety in modern societies from an evolutionary perspective



2 In pursuit of the ‘evolutionary root’ of social anxiety

2.1 Selection mechanisms

Sexual selection addresses the specific selection mechanisms that govern the reproductive success of animals, including humans (and plants for that matter). The concept of sexual selection can be understood as the differences in reproductive success caused by competition over a mate and based on how a character trait is expressed [23]. Sexual selection is divided into intersexual selection (which is the mechanism of mate choice) and intrasexual selection (which is the mechanism of competition for mates). The extravagant tail of a peacock (the male peafowl) is a classic example of the evolutionary long-term effect of intersexual selection in the animal world, where its function is solely to impress and make the male peacock attractive to peahens (females) that are ready to mate.

When it comes to showing off how splendid humans are, we have a greater repertoire of signals to play on than just bodily and psychological traits. Nonbodily traits, or extended phenotypic traits [24, 25], can also influence sexual selection. In humans such traits range from materialistic possessions (including property of houses and cars) to artistic production as well as presenting oneself on social media [25]. Thus, sexual selection has been proposed to explain a vast realm of human behaviour—not just the features of human bodies [26]. In addition to sexual selection, there are other forms of social interactions that lead to both social competition and collaboration—so-called social selection—which are also thereby strong drivers of selection [27]. Given that coupling for sexuality and cohabitation are just one of the many forms of social interaction means that we can divide social selection forces into two main categories; nonsexual social selection and sexual selection [28]. In line with this, social selection forces can be categorized into three subgroups: nonsexual social selection, intrasexual selection, and intersexual selection.

2.2 Social rank and hierarchies are handed down to us

Humans are social by nature, and Darwin [29] described this in *The Descent of Man* in the following manner:

Man is a social animal—everyone will admit that man is a social being. We see this in his dislike of solitude, and in his wish for society beyond that of his own family. Solitary confinement is one of the severest punishments which can be inflicted. (p. 108)

What is more, humans possess a fundamental desire for social status [30]. An evolutionary view emphasizes that status-seeking and the pursuit of resource acquisitiveness affect our daily behaviour and thought processes [31]. The ability to perceive, assess and manipulate other individuals is well known in primates, but in the animal kingdom it is by no means unique to primates [32]. In the diverse animal kingdom, herd mentality, social rank and hierarchies are also widespread phenomena. Among animal species living in social groups, individuals are skilled at navigating their way within a hierarchical system and finding their place in the ranking [33]. Judgment of social rank is the mechanism by which individuals evaluate their position within a social group [34], a mechanism that helps us correct ourselves so as not to fall out of the group.

From an evolutionary perspective, being able to navigate oneself in a social group has been crucial for survival and reproductive success. Evolutionary drivers of selection have favoured skills that make us accurate in estimating the degree of other people’s qualities. These skills are crucial to us, as they were to our ancestors, when establishing partners and selectively seeking membership of social groups [35], as well as when selecting sexual partners and life partners. At the same time, throughout all our history, it has been important for people to show their good sides in social arenas so that they become an attractive partner and build a good personal reputation. This can give individuals access to important resources in life. Throughout our evolutionary history, people’s sense of pride may have played an important role in the communication of social status and the establishment of social hierarchies [36].

2.3 The fitness benefits of collaboration and choice of partner

From a biological standpoint, *collaborative behaviour* refers to the forms of social behaviour that are either carried out as altruistic actions or are mutually beneficial to the individuals involved. Collaborative approaches are vital behavioural strategies for social animals, but inherited willingness to collaborate can only evolve when it is the strategy that provides

the best expected survival and reproductive fitness for individuals in a life-course perspective [37]. The benefits of collaborating depend on whom one collaborates with. Thus, mate choice and preferences are evolutionarily adaptive abilities—not only for the purpose of sexual relationships but also for collaborative relationships [38].

The idea underlying the concept of *biological markets* was formally introduced by Noë and Hammerstein [39, 40], and is an extension of traditional models for estimating the mutual benefits of partnerships with people one is not genetically related to. In so-called *biological markets*, high 'market value' is rewarded with being an attractive collaborative partner (for friendships, coalitions, or alliances), and a sexual partner. The idea is that social selection favours individuals who are selective when choosing partners, where fitness benefits per resource unit invested are maximized [41]. These fitness benefits of collaboration may be various forms of helping behaviour, access to food, protection, shelter and tolerance. When the majority of people are fastidious about whom they want to enter into close social ties with, the most popular partners will be in short supply. This forces a competitive relationship to exist between people looking for one or more partners with whom they would like to build social relations. Through biological evolution, we have therefore undergone adaptations that enable us to present ourselves in an attractive manner, as well as select favourable partners based on a set of quality criteria [38, 41]. Furthermore, when good trust-based collaborative relationships are built up, one must do what is needed to retain one's partners [41], and, on the other hand, be able to reject uncooperative partners [42].

2.4 Social comparison and trait social anxiety as an evolutionary adaption

People's clear awareness of their own standing and reputation may have to do with the fact that we want to be perceived as a popular collaborative partner. In *The Descent of Man* [29], Charles Darwin highlighted how concerned people are about what others think of them. Darwin pointed out that shame and immoral acts remain part of our memories throughout our lives, and those who do not feel sympathy and have morals will at least be anxious about being punished for their misdeeds. Among other things, Darwin [29] writes:

Man, from the activity of his mental faculties, cannot avoid reflection: past impressions and images are incessantly and clearly passing through his mind. Even when we are quite alone, how often do we think with pleasure or pain of what others think of us—of their imagined approbation or disapprobation; and this all follows from sympathy, a fundamental element of the social instincts. A man who possessed no trace of such instincts would be an unnatural monster. (p. 112)

Being concerned with what others think of us as individuals may have evolved as an important characteristic helping us to master the social game. Social approval and a good reputation can reward us in the form of access to vital resources and support from fellow citizens [43]. A psychological reaction in the form of 'healthy' concern about what others think of us helps us to be aware and assess how we should appear to be perceived as a reliable and attractive partner [44]. On the other hand, social comparisons may cause psychological stress, especially if one feels inferior or worthless [45]. To be concerned that others may hold high standards for your performance is supposed to be in a close interactive relationship with self-appraisal and subjective social anxiety [46]. According to the theory of the human brain's dominance behavioural system [47], depressive and anxiety disorders are correlated with subordination [48]. Moreover, social anxiety appears tied to a lower desire to be in roles of power and leadership [48].

How we respond to the rewards and punishments that others give us depends on the mood we find ourselves in. Mood and mood swings may have evolved as aids that help us cope with and adapt to the social norms set in society. However, mood systems do not differ from other biological mechanisms in the sense that they can also be counterproductive by making us hypersensitive and dysregulatory [49]. People who perceive themselves as having a lower social rank compared to others have a greater tendency for social anxiety, which in turn may influence depression [50–52]. Depression causes a person to refrain from the previous patterns of behaviour they were in the habit of employing, and a behavioural change can then be adaptive and beneficial in restoring our popularity in the group [52, 53], but it does not imply that the depression disorders, as with social anxiety disorder, in themselves are adaptive [54].

2.5 Social status and social anxiety in the years of adolescence

Adolescence, the phase in life when one begins to detach oneself from one's parents and construct one's own socio-economic position [55], is also a time of changes in social behaviours [56]. Subjective social status (SSS) is reported to be associated with mental health in adolescents [57, 58]. At the same time, this is a phase in life when one is most vulnerable in relation to developing social anxiety disorder [59, 60]. From an evolutionary perspective, being an attractive

sexual partner is most important during one’s youth and young adulthood in terms of reproductive fitness—especially for women, who have a shorter period of fertility than men. In addition, skills such as school performance and social network building in this phase of life provide an important foundation for one’s future socioeconomic prospects [61]. Since attractiveness and social affiliation are of great importance regarding reproductive fitness, sensitivity to signals of social rejection and carefulness not to behave in ways that are considered unacceptable among other group members [62, 63] may be especially appropriate during adolescence and young adulthood. Social anxiety may be a form of competitive anxiety, where various submissive defences may have evolved as a consequence of attempts to compete [64]. In addition to negative experiences with peers, early life stress caused by parental factors (such as overprotective reactions, parental rejection, or lack of emotional warmth) may also predispose young people to have a low society SSS [58] and social anxiety symptoms [21].

2.6 Social anxiety as an adaption through social selection

Given that individuals embedded in mutually supportive social networks are considered to have preferential access to resources needed for survival and reproduction [20], the present study hypothesises that social anxieties have evolved through different types of social selection mechanisms (see Fig. 2). Social selection may have been the evolutionary force behind both defence strategies and show-off strategies where social anxiety is an adaptive trait. Defence strategies may have evolved through nonsexual social selection and intrasexual selection to overcome social threats in terms of exclusion and being left alone, as well as to prevent defeats in competitive situations. Thus, social anxiety may be a form of competitive anxiety, where various submissive defences may have evolved as a consequence of attempts to compete [64]. However, humans do not just strive to maintain their social position but also to gain access to new social networks and social ingroups to increase their social status [65, 66]. Furthermore, humans are seeking coupling for sexuality and cohabitation where intersexual selection has played an important role. The importance of social status mobility for reproductive success has forced the need to appear attractive and show off to potential mates.

The present study broadly aligns with the evolutionary approach that social anxiousness is an adaption due to the advantage of the ability to identify and respond to social threats (see [21]). Leary [20] proposed that social anxiety may be regarded as an early warning system. However, the term ‘social threats’ may not encompass the full evolutionary

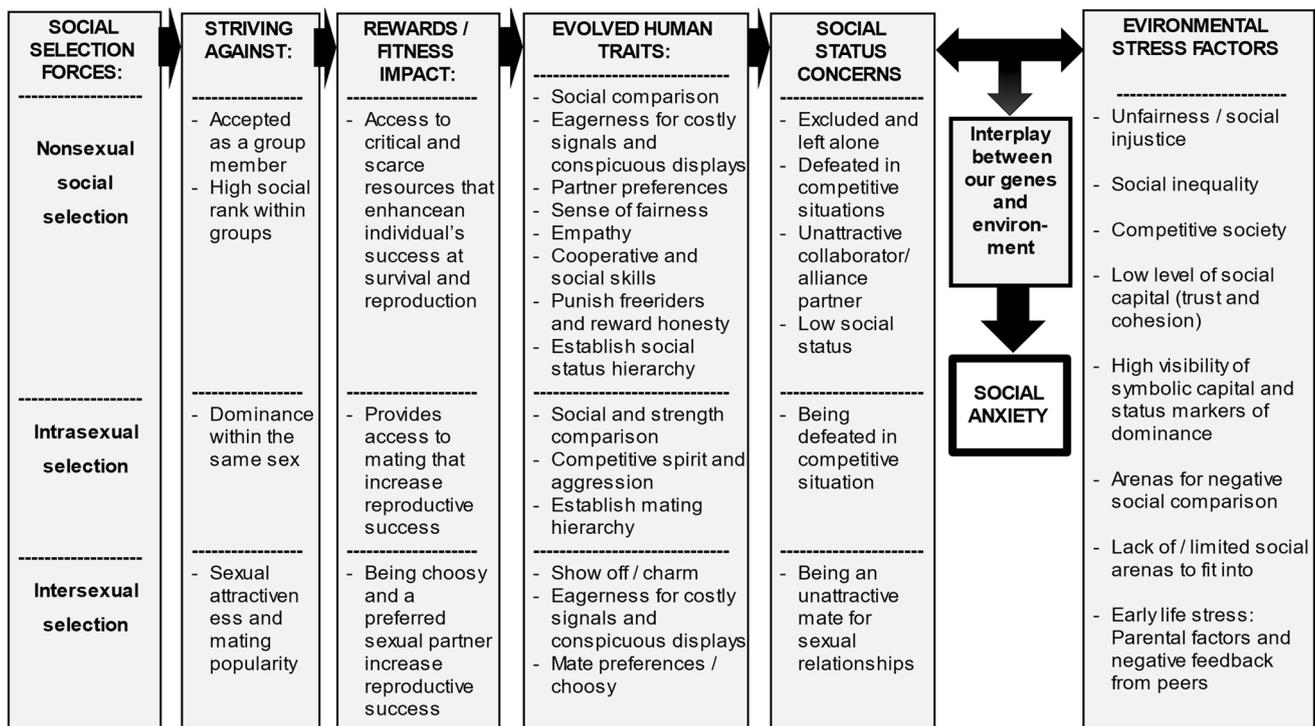


Fig. 2 A evolution-theoretical perspective of why humans are predisposed to social anxiety, and socioeconomic and sociocultural conditions that may enhance people’s propensity to develop social anxiety

explanation of social anxiety. The evolution of human traits that predisposed us to social anxiety is not only rooted in the adoption of social threats by competitors but also the need to consider and care about what others think about us when meeting attentive and potential partners (which actually is a social opportunity). The self-presentation theory extended with theories of humans' ability to monitor the social environment for self-relevant cues (referred to as the 'sociometer') and perceived relational value supports this view [20]. However, distinguishing different components of sociometric status is necessary when considering the link to social anxiety [67]. Both access to new desired social arenas and maintaining existing ones, as well as popularity, are not something one can simply decide on independently by defeating others. Other ingroup members, especially those who have achieved high social status, often have great influence on a person's future position in 'a social club'. This uncontrollability of others can be perceived as psychologically stressful.

Partner/mate choice is an important mechanism that acts in both intersexual selection and nonsexual social selection. To appear as an attractive person, it is beneficial to care about what others think of you—and thus have the opportunity to adapt your own way of being according to what appeals to others. Sexual selection operating ancestrally in humans might have been comparatively strong—stronger than is often assumed [68]. Thus, although Karasewich and Kuhlmeier [21] questioned whether traits of social anxiety have had an evolutionary positive effect on individuals' ability to reproduce, it might be that both direct competition between rivals for access to mates and mate choice through sexual selection have played an important role in the evolution of social anxieties as an adaptive response. The evolution of social anxiousness may also have been controlled by frequency-dependent selection in a population and to environmental conditions which fluctuate over time and place. Nevertheless, there is a trade-off between how much one should worry about one's own way of being rather than appearing confident and uncompromising in meeting others. The fear of social situations exist along continua across the general population. Social anxieties/fears range from no anxiety (fearlessness) to 'normal' fears to psychopathological extremes such as social anxiety disorder [69]. Furthermore, although social status concerns and 'normal' fears appear likely as an adaptive product of evolution, it may be that severe forms of social anxiety are a result of by-products or noise rather than the direct product of natural selection [70]. Dysfunctional consequences of social anxiety may have been reinforced in modern society due to the evolutionary mismatch between the ancestral environment and modern society [71].

3 The impact of the socioeconomic environment on the occurrence of psychological distress and social anxiety

3.1 Social inequality and mental health

Population health follows a social gradient, with health outcomes being associated with social position, which is a remarkably widespread phenomenon [72, 73]. Not only individuals' own level of socioeconomic resources and social position but also the contextual characteristics in which they live appear to associate with the risk of suffering from different mental health problems [74]. Lantz and Pritchard [75] define socioeconomic environment "as a place with geographically defined boundaries that also has economic, educational, social, cultural, and political characteristics" (p. 1). Previous studies have emphasized that aspects of the socioeconomic environment (measured within different units of geography), such as income inequality [76–78] and local economic conditions [79], are likely to affect the mental health and well-being of the citizens. The social inequalities in mental health can be due to the scarcity of material resources among the subpopulation [80], as well as weak social capital (including lack of trust) and the psychological mechanisms that primarily arise in a skewed and class-divided society [81–83]. Alternatively, they can be caused by people with mental health issues drifting down in socioeconomic position, termed as 'the social selection hypothesis' [84]. However, none of these theories is mutually exclusive.

The psychosocial approach to social health differences emphasizes the psychological strains that can arise when (i) not gaining access to the same material benefits as other fellow citizens, (ii) being left out of a popular in-group, or (iii) feeling socioeconomically inferior [76, 83]. However, an individual's social status and position in society is multifaceted and can be inferred from different social dimensions and by different contexts. Humans can take advantage of multiple strategic pathways to increase their social status where status is inferred from different social dimensions and by different contexts [66]. Earning higher status and viewing higher status individuals elicits neural activity in the ventral striatum, and status-based reward responses may also depend on perceiver characteristics, such as their subjective status [85].

Across countries, the prevalence of social anxiety is associated with specific cultural, economic and sociodemographic features [86]. Cultural context might influence the link between psychological well-being and rank in society [87].

Collectivistic countries report a greater prevalence of social anxiety and fear of negative evaluation than individualistic countries [88, 89]. Moreover, Wilkinson [90] writes, “Both in terms of its likely intensity and the large proportion of the population exposed to it, social anxiety is a very plausible central source of the chronic anxiety that depresses health standards and feeds into the socioeconomic gradient in health” (p. 60). A timely question is why differences in the social environment are crucial to how much social anxiety people experience and how this is related to evolved human traits.

3.2 Display of status and use of symbolic capital

Communication and information exchange by animals is key to their adaptive behaviour [91]. Among the many potential sources of information available to an animal are ‘signals’ which can be understood as “sources of socially acquired information that are elicited to influence the behaviour of others” [91] (p. 187). Sexually selected ornaments, such as colourful plumage or beautiful songs, and weapons, such as antlers, are frequently used as signals of male quality in the animal kingdom [92]. In the literature of biological science, several approaches to the evolution of signals have been thoroughly reviewed. A clearly relevant evolutionary approach to social status by dominance and partner choice is the costly signalling theory [93], an idea introduced in the field of evolutionary biology by Amotz Zahavi [94, 95]. According to costly signalling theory, signals must be honestly and reliable (at least partly) to be profitable for both the sender and the recipients. Although the absolute cost of signalling (i.e. the expenditures and resources required to send the signal) is supposed to be the same for all senders, the relative cost is lower for high-quality individuals than low-quality individuals [93]. Furthermore, “costly-signalling theory involves the communication of attributes that are relatively difficult or expensive to perceive directly and that vary in quality, intensity, or degree between signallers” [96] (p. 224). Conspicuous signalling through extravagant characters could serve as a function in mate attraction but also to threaten rivals [97].

Signalling theory also has deep roots in the social sciences which fits well with the biological approach (see [98–102]) and provides an opportunity to integrate the theory of symbolic communication with social behaviour and status competition in humans [96, 103]. Individuals’ socioeconomic position in terms of financial, physical or intellectual status can be conveyed by visually accessible signals, or cues, such as clothing, car ownership, and distinct patterns of nonverbal behaviour [104]. Some cultural products are ornamental artifacts that may function as signals to potential lovers—referred to as the cultural courtship model—or to potential coalitional members with the intention of obtaining status from individuals in a coalition [105]. The concept of symbolic capital deals with material exhibitions of social status and how it is structurally limited in a society [106]. In this way, symbolic capital is not only a simple reflection on economic standing, but rather constitutes a separate dimension of social position with relevance to health outcomes [106]. Visualization can produce neurological and psychological processes related to social comparison and socioeconomic inequality [107, 108]. Visualization of various forms of capital can cause people to perceive a situation as competitive. This leads them to believe that their materialistic wealth signals social position and attractiveness; and they therefore spend a greater percentage of their income on conspicuous consumption [109], as well as provoking a fear of inadequacy which results in them avoiding collaboration [110]. In an experimental study on social networks, Nishi et al. [110] found that economic inequality alone had relatively little effect on willingness to collaborate and the degree of sense of community. Reflections concerning the pronounced use of symbolic markers and visualization of differences in quality—in the form of both materialistic and human capital—may have relevance in understanding why increasing degrees of socioeconomic inequality can exacerbate mental health illness and health disparities in a population.

Luxury is an intrinsic part of civilized society [111]. The luxury goods industry has in recent decades been one of the fastest growing business sectors [112]. Luxury products are consumed worldwide as status symbols [113, 114], and persons who display luxury could yield benefits in social interactions [115]. Arrogance is a human trait reflecting the proclivity to establish one’s social superiority over others. Thus, use of luxury items or expensive brands could be viewed as a consumer arrogance that may provide benefits in competitive environments [116]. However, luxury makes economic and social inequality highly visible [117]. Conspicuous display of luxury products could elicit feelings of envy [118], and exposure to luxury advertisements may evoke the psychological state of feeling rejected and socially excluded [119]. Moreover, “signalling-by-cultural-experiences” (p. 302) can be considered another variant of conspicuous consumption [120], and consumption of cultural products increases the visibility of inequalities in everyday life. Delhey et al. [121] have pointed out that the larger the cultural class divisions in a given society are, the more the people living in that society experience the feeling of not counting much in the eyes of others (referred to as “status anxiety”). Studies have demonstrated that conspicuous spending (i.e. consumption of goods and services that are visible to outsiders and positional) increases life satisfaction, while consumption expenditures to meet their basic needs do not affect life satisfaction significantly [122, 123]. Wu [123] stated that “If we look at a society as a whole, the gain in happiness to those

who spend more on conspicuous consumption is accompanied by the loss in happiness to those who spend less" (p. 2759). Moreover, a meta-analysis of experimental studies suggested that materialistic cues cause lower individual and societal well-being [124].

Evolutionary models demonstrate that social anxiety is associated with sensitivity to status-loss events such as humiliations and physical threats [125]. Adolescents are exposed to status and competitive environments at several social arenas—such as at home, school, leisure activities, and social media—and the desire to be accepted by one's peers, and rejection avoidance, is particularly present in adolescence. Thus, adolescents are sensitive to cues within their social environment [126]. The growing use of social media and more frequent browsing in modern society, which has created new arenas for display of social status and social comparison, may have some negative impacts on psychological well-being and social anxiety [127–129] but can also create greater opportunities to form new relationships by finding social arenas where one feels one belongs and is noticed.

3.3 Sense of fairness and community social capital

Another human trait that may help explain why socioeconomic inequalities have a negative association with health is our well-developed sense of what is fair reward based on the effort we put into an activity. Fairness is essential for people to maintain collaboration in a biological market [130, 131], especially in large groups. Individuals who collaborate will often outcompete those who do not [132], but for collaboration to be maintained between fellow members of the species and serve as an evolutionarily stable strategy (ESS), social groups and society must solve the problem of shirkers and 'free riders'. The well-developed sense of fairness and empathy that most people have [133] may have evolved as a consequence of and solution to this problem of free riders [134]. Feeling the need to punish shirkers and free riders in society may be an expression of a sense of fairness [135]. Most people seem to prefer the fair distribution of resources [136, 137] which is perceived as being more important than equal distribution [138]. Large wealth and income disparities in many countries, such as the United States where a high prevalence of anxiety has also been reported [5, 59], can be perceived as an unfair reward system by many citizens [139], and this sense of unfairness can possibly have a negative impact on their psychological well-being. Moreover, in EU countries the relationship between national life satisfaction and social justice is demonstrated [140].

High levels of community social capital (including the trust of others, social support and neighbourhood cohesion) form contextual conditions that may be beneficial to community members when it comes to how citizens behave together and pursue shared objectives. A socially inclusive environment with a high level of trust can contribute as a means for all citizens to form social networks and hence get a fair sense of being able to succeed in the 'biological market'. Further, various elements of social capital may be important mediating factors between a community, the collective attributes of its members and individual well-being and mental health [141, 142]. Consistent with evolutionary models of social anxiety [143], the psychological distress of social uncertainty, particularly combined with uncontrollability [144], is suggested to be a significant trigger of social anxiety [145, 146]. Brosnan et al. [143] also expected increases in expression of anxiety when individuals are facing unstable relationships, which may occur as a consequence of conflict or in the context of aggressive behaviour.

3.4 Assumptions, predictions and practical implications

A more fundamental understanding of social fear triggers and contexts [147] is needed. Knowledge regarding how and why humans struggle to handle modern stressors is necessary for the purpose of clinical practise and public health interventions aimed to benefit individuals and societal self-awareness of acts that impair or promote well-being [15]. Public health experts need to know how to design social arenas and environments that do not stimulate threats among socially anxious individuals. Moreover, practitioners and therapists will benefit from developing treatment programs based on anxiety-provoking situations in modern day-to-day life, and training people to handle or avoid such exposure, [70] which takes place both through face-to-face interactions and digital communication. That said, an evolutionary view of what social stimuli and specific socioeconomic environments trigger social anxiousness is challenging and requires both ultimate and proximate explanations. The present study has several limitations related to the incompleteness of our knowledge about the evolution of humans. Moreover, the unclear mismatch between the ancestral environment and the complex social interactions people face today, make this study of social anxiety more prone to misinterpretation. However, a valuable first step is to address the social selection forces that presumably created social status concerns in our ancestors' lives, as novelly illustrated in Fig. 2. This ultimate

explanation helps to shed light and build assumptions about whether certain circumstances of contemporary human life act as stressors. From that biological perspective, researchers could attempt to identify and generate predictions of how present-day human psychology interacts with certain stimuli in current environments. Furthermore, these stated predictions should be tested in specific social environments by measuring adolescents' thoughts, feelings and behaviour as a response to visual exposure over time of various forms of social capital and conspicuous signalling.

Certain sociocultural and socioeconomic conditions may evoke our sociometric system, step up negative social comparisons and be perceived by observers as threatening (Fig. 2). The present study assumes that a low level of trust and high perceptions of unfair socioeconomic inequalities in a community increase conflicts, make people less confident about their 'market value', or 'relational value' (see Leary [20]) and cause them to be less receptive to entering into partnerships across social strata. Thus, the present study predicts that the occurrence of social anxiety correlates positively with the level of mistrust and socioeconomic inequality in a local community. Furthermore, this study assumes that visual status markers of dominance increase individuals' perception of being in a competitive environment for social power, which in turn can be perceived as threatening. If so, one can predict that socioeconomic inequality expressed through visual dominance and highly observable status markers (such as conspicuous spending and skill-based competence) contributes to increase the occurrence of status concerns and social anxiety in local environments and social groups. This prediction of visible displays applies to important status markers that are agreed upon by social consensus within the individual citizen's reference groups for social comparison. Further studies are needed on how specific types of behaviour and what kinds of displays by others could prompt more intense social anxiety. Predictions should also be generated upon different types of social relationships (e.g. differentiated by rivals, genetically unrelated alliance partner, prospective mate and siblings), when viewed from an evolutionary perspective.

Bronfenbrenner's bioecological systems theory proposes that children's development and socialisation occurs through interactions between individual factors and multiple levels of their social and cultural environment [148]. The closest surroundings and nearest relationships, such as family members, peers and teachers, are considered part of the child's 'microsystem'. As most children spend a large amount of their time on a weekly basis at schools, schoolyards and classrooms provide key arenas within their 'microsystem' to establish well-functioning communication skills and attitudes toward self, peers and society. However, typical feared and avoided situations for many socially anxious children and adolescents are related to school contexts such as performing in front of schoolmates and teachers [149]. The ordinary school day and learning environments have the potential to make a substantial difference in young people's lives and well-being, and is thus a unique setting for interventions and preventive measures. The evolution-theoretical perspective of social status concerns and the vulnerability to social anxiety outlined in the present paper, are prompts for local school environments to build upon social cohesion, social capital in networks and social contacts. Policies for school qualities, including structural and process characteristics, should aim at these health-promoting conditions.

In addition to the time spent with their immediate families and at school, social media use has become deeply integrated into adolescents' daily lives, offering the opportunity for constant social comparison. Just within the last decade the amount of time adolescents spend on digital media has increased considerably, which gives rise to a wide range of research questions. Digital technologies and use of social media have shaped the way modern humans communicate and increased the visibility of one's own position within a wide domains of social status hierarchies. The online environment, characterised by many weak and unstable social connections, may also be changing our cognition [150]. Thus, the digital media space illustrates how contemporary society has created an environment for a social life vastly different from the small stable networks in which people once evolved. This evolutionary mismatch perspective on the modern environment may help to explain negative psychological outcomes [71, 151, 152] such as why modern humans are vulnerable to develop and maintain social anxiety [153]. On the one hand, it might be argued that the sociocultural evolution has outpaced the plausible explanation of adaptation significance and that evolutionary approaches have lost their relevance in modern societies. Moreover, hypotheses derived via the evolutionary lines of argument are sometimes criticised for being 'just-so stories' and unfalsifiable although this has been counter-argued [154–156]. On the other hand, one can argue that evolutionary adaptive explanations can help us identify and predict the impact of new social stimuli introduced by the expansion of digital communications in a modern society. Further development of a conceptual framework that integrates psychology, evolution, culture and sociodemographic structures would be useful to resolve questions arising from the societal trends of socioeconomic inequalities in mental health. In clinical and social/community psychology, hypotheses of the interplay between subjective social status and social anxiety could build on this framework. More interdisciplinary research is needed that integrates mental health, evolutionary psychology and sociocultural effects.

4 Summary

This study has highlighted assumptions that people's (i) strong need to compare themselves to others, (ii) well-developed social 'antennae' for what others think of them, and (iii) need to signal their social status based on visual 'ornamentation' and attributes are adaptive traits caused by social selection, including standard sexual selection, over an extended evolutionary time perspective. The sexual and social aspects of biological evolution have created the need to appear as an attractive partner—both as a mate and in social alliances—as a distinct trait among humans. Thus, it can be argued that an evolutionary approach to social anxiety should rely on the broad concept of social selection (subdivided into nonsexual social selection, intersexual selection, and intrasexual selection) where competitive mentality, eagerness to show off and ability to cooperate are of crucial importance. Moreover, this study argues that contemporary socioeconomic stress factors (including costly displays) may also affect a society's prevalence and incidence of social anxiety.

The current study reflects on whether a sense of unfairness and lack of trust and the pronounced use of symbolic markers and visualisation of differences in quality—both in the form of materialistic and human capital—may have relevance in understanding why increasing degrees of socioeconomic inequality can exacerbate psychological distress, social anxiety and health disparities in a population. The psychological processes associated with a desire to remain or become an attractive fellow human being can make us anxious about failing and being left out of social groups or being judged as inadequate by desired partners. People want to appear to have a high biological market value, emphasising their social status and partnership qualities. This may have resulted in the evolution of human characteristics such as the ability to make social comparisons, and an understanding of one's own and others' place in a status hierarchy. The psychological dark side of these evolutionary drivers of selection in humans has resulted in concerns about being inadequate, as well as social stress that unfortunately cause some people to develop social anxiety and depression. In a competitive and digitalised modern society, with ever-increasing opportunities to expose visual status markers and make social comparisons (e.g. via social media), and where socioeconomic inequalities (which seems unfair among many citizens) are on the rise, the price that society and individuals have to pay in terms of mental health issues and psychological well-being can be high. Thus, both clinicians and policymakers should be aware of how and why changes in a society's socioeconomic and sociocultural conditions can make a difference for the citizens when it comes to triggering or toning down certain evolved human traits that predispose psychological distress and social anxiety.

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Declarations

Competing interests The author has no competing interests to declare that are relevant to the content of this article.

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References

1. Whiteford HA, Degenhardt L, Rehm J, Baxter AJ, Ferrari AJ, Erskine HE, et al. Global burden of disease attributable to mental and substance use disorders: findings from the Global Burden of Disease Study 2010. *Lancet*. 2013;382(9904):1575–86. [https://doi.org/10.1016/S0140-6736\(13\)61611-6](https://doi.org/10.1016/S0140-6736(13)61611-6).
2. Trautmann S, Rehm J, Wittchen HU. The economic costs of mental disorders: Do our societies react appropriately to the burden of mental disorders? *EMBO Rep*. 2016;17(9):1245–9. <https://doi.org/10.15252/embr.201642951>.
3. Potrebny T, Wiium N, Lundegård MM-I. Temporal trends in adolescents' self-reported psychosomatic health complaints from 1980–2016: A systematic review and meta-analysis. *PLoS ONE*. 2017;12(11):e0188374. <https://doi.org/10.1371/journal.pone.0188374>.
4. Hagquist C, Due P, Torsheim T, Välimaa R. Cross-country comparisons of trends in adolescent psychosomatic symptoms—a Rasch analysis of HBSC data from four Nordic countries. *Health Qual Life Outcomes*. 2019;17(1):27. <https://doi.org/10.1186/s12955-019-1097-x>.
5. Jefferies P, Ungar M. Social anxiety in young people: A prevalence study in seven countries. *PLoS ONE*. 2020;15(9):e0239133. <https://doi.org/10.1371/journal.pone.0239133>.
6. Krokstad S, Weiss DA, Krokstad MA, Rangul V, Kvaløy K, Ingul JM, et al. Divergent decennial trends in mental health according to age reveal poorer mental health for young people: repeated cross-sectional population-based surveys from the HUNT Study, Norway. *BMJ Open*. 2022;12(5):e057654. <https://doi.org/10.1136/bmjopen-2021-057654>.
7. Dierckens M, Richter M, Moor I, Elgar FJ, Clays E, Deforche B, et al. Trends in material and non-material inequalities in adolescent health and health behaviours: A 12-year study in 23 European countries. *Prev Med*. 2022;157:107018. <https://doi.org/10.1016/j.ypmed.2022.107018>.
8. Elgar FJ, Pfortner T-K, Moor I, De Clercq B, Stevens GW, Currie C. Socioeconomic inequalities in adolescent health 2002–2010: a time-series analysis of 34 countries participating in the Health Behaviour in School-aged Children study. *Lancet*. 2015;385(9982):2088–95. [https://doi.org/10.1016/S0140-6736\(14\)61460-4](https://doi.org/10.1016/S0140-6736(14)61460-4).
9. Barrett AE, Turner RJ. Family structure and mental health: The mediating effects of socioeconomic status, family process, and social stress. *J Health Soc Behav*. 2005;46(2):156–69. <https://doi.org/10.1177/002214650504600203>.
10. Valkenburg PM, Meier A, Beyens I. Social media use and its impact on adolescent mental health: An umbrella review of the evidence. *Curr Opin Psychol*. 2022;44:58–68. <https://doi.org/10.1016/j.copsyc.2021.08.017>.
11. Nesi J. The impact of social media on youth mental health: challenges and opportunities. *N C Med J*. 2020;81(2):116–21. <https://doi.org/10.18043/ncm.81.2.116>.
12. De Looze M, Cosma AP, Vollebergh WA, Duinhof EL, De Roos S, van Dorsselaer S, et al. Trends over time in adolescent emotional wellbeing in the Netherlands, 2005–2017: links with perceived schoolwork pressure, parent-adolescent communication and bullying victimization. *J Youth Adolesc*. 2020;49(10):2124–35. <https://doi.org/10.1007/s10964-020-01280-4>.
13. Nesse RM, Stearns SC. The great opportunity: evolutionary applications to medicine and public health. *Evol Appl*. 2008;1(1):28–48. <https://doi.org/10.1111/j.1752-4571.2007.00006.x>.
14. Gluckman PD, Low FM, Buklijas T, Hanson MA, Beedle AS. How evolutionary principles improve the understanding of human health and disease. *Evol Appl*. 2011;4(2):249–63. <https://doi.org/10.1111/j.1752-4571.2010.00164.x>.
15. Dornisch S. The Evolution of Well-Being: An Anthropology-Based. *Multidiscip Rev Hum*. 2022;2(4):161–76. https://doi.org/10.3390/human_s2040011.
16. Troisi A. Gender differences in vulnerability to social stress: a Darwinian perspective. *Physiol Behav*. 2001;73(3):443–9. [https://doi.org/10.1016/S0031-9384\(01\)00459-0](https://doi.org/10.1016/S0031-9384(01)00459-0).
17. Bateson M, Brilot B, Nettle D. Anxiety: an evolutionary approach. *Can J Psychiatry*. 2011;56(12):707–15. <https://doi.org/10.1177/070674371105601202>.
18. Polák J, Rádlová S, Janovcová M, Flegr J, Landová E, Frynta D. Scary and nasty beasts: Self-reported fear and disgust of common phobic animals. *Br J Psychol*. 2020;111(2):297–321. <https://doi.org/10.1111/bjop.12409>.
19. Norton AR, Abbott MJ. The role of environmental factors in the aetiology of social anxiety disorder: A review of the theoretical and empirical literature. *Behav Change*. 2017;34(2):76–97. <https://doi.org/10.1017/bec.2017.7>.
20. Leary MR. Social anxiety as an early warning system: A refinement and extension of the self-presentation theory of social anxiety. *Social anxiety: Clinical, developmental, and social perspectives*. 2nd ed. London: Academic Press; 2010. p. 471–86.
21. Karasewich TA, Kuhlmeier VA. Trait social anxiety as a conditional adaptation: A developmental and evolutionary framework. *Dev Rev*. 2020;55:100886. <https://doi.org/10.1016/j.dr.2019.100886>.
22. Darwin C. *The descent of man, and selection in relation to sex*. 1st ed. London: John Murray; 1871.
23. Andersson M. *Sexual selection*. Princeton: Princeton University Press; 1994.
24. Bailey NW. Evolutionary models of extended phenotypes. *Trends Ecol Evol*. 2012;27(10):561–9. <https://doi.org/10.1016/j.tree.2012.05.011>.
25. Luoto S. An updated theoretical framework for human sexual selection: from ecology, genetics, and life history to extended phenotypes. *Adapt Hum Behav Physiol*. 2019;5(1):48–102. <https://doi.org/10.1007/s40750-018-0103-6>.
26. Wilson ML, Miller CM, Crouse KN. Humans as a model species for sexual selection research. *Proc R Soc Biol Sci*. 1866;2017(284):20171320. <https://doi.org/10.1098/rspb.2017.1320>.
27. Tobias JA, Montgomerie R, Lyon BE. The evolution of female ornaments and weaponry: social selection, sexual selection and ecological competition. *Philos Trans R Soc Biol Sci*. 2012;367(1600):2274–93. <https://doi.org/10.1098/rstb.2011.0280>.
28. Lyon BE, Montgomerie R. Sexual selection is a form of social selection. *Philos Trans R Soc Biol Sci*. 2012;367(1600):2266–73. <https://doi.org/10.1098/rstb.2012.0012>.
29. Darwin C. *The descent of man, and selection in relation to sex*. 2nd ed. London: John Murray; 1879.
30. Anderson C, Hildreth JAD, Howland L. Is the desire for status a fundamental human motive? A review of the empirical literature. *Psychol Bull*. 2015;141(3):574. <https://doi.org/10.1037/a0038781>.

31. Hawley PH. Social dominance in childhood and its evolutionary underpinnings: Why it matters and what we can do. *Pediatrics*. 2015;135(Supplement 2):S31–8. <https://doi.org/10.1542/peds.2014-3549D>.
32. Byrne RW, Bates LA. Primate social cognition: uniquely primate, uniquely social, or just unique? *Neuron*. 2010;65(6):815–30. <https://doi.org/10.1016/j.neuron.2010.03.010>.
33. Sapolsky RM. The influence of social hierarchy on primate health. *Science*. 2005;308(5722):648–52. <https://doi.org/10.1126/science.1106477>.
34. Gilbert P, Price J, Allan S. Social comparison, social attractiveness and evolution: How might they be related? *New Ideas Psychol*. 1995;13(2):149–65. [https://doi.org/10.1016/0732-118X\(95\)00002-X](https://doi.org/10.1016/0732-118X(95)00002-X).
35. Gong X, Sanfey AG. Social rank and social cooperation: Impact of social comparison processes on cooperative decision-making. *PLoS ONE*. 2017;12(4):e0175472. <https://doi.org/10.1371/journal.pone.0175472>.
36. Tracy JL, Shariff AF, Cheng JT. A naturalist's view of pride. *Emot Rev*. 2010;2(2):163–77. <https://doi.org/10.1177/1754073909354627>.
37. Nowak MA. Five rules for the evolution of cooperation. *Science*. 2006;314(5805):1560–3. <https://doi.org/10.1126/science.1133755>.
38. Barclay P. Biological markets and the effects of partner choice on cooperation and friendship. *Curr Opin Psychol*. 2016;7:33–8. <https://doi.org/10.1016/j.copsyc.2015.07.012>.
39. Noë R, Hammerstein P. Biological markets: supply and demand determine the effect of partner choice in cooperation, mutualism and mating. *Behav Ecol Sociobiol*. 1994;35(1):1–11. <https://doi.org/10.1007/BF00167053>.
40. Noë R, Hammerstein P. Biological markets. *Trends Ecol Evol*. 1995;10(8):336–9. [https://doi.org/10.1016/S0169-5347\(00\)89123-5](https://doi.org/10.1016/S0169-5347(00)89123-5).
41. Barclay P. Strategies for cooperation in biological markets, especially for humans. *Evol Hum Behav*. 2013;34(3):164–75. <https://doi.org/10.1016/j.evolhumbehav.2013.02.002>.
42. McNamara JM, Barta Z, Fromhage L, Houston AI. The coevolution of choosiness and cooperation. *Nature*. 2008;451(7175):189–92. <https://doi.org/10.1038/nature06455>.
43. Baumard N, André J-B, Sperber D. A mutualistic approach to morality: The evolution of fairness by partner choice. *Behav Brain Sci*. 2013;36(1):59–78. <https://doi.org/10.1017/S0140525X11002202>.
44. Carlson EN. Meta-accuracy and relationship quality: Weighing the costs and benefits of knowing what people really think about you. *J Pers Soc Psychol*. 2016;111(2):250. <https://doi.org/10.1037/pspp0000107>.
45. Gilbert P. Psychotherapy for the 21st Century: An integrative, evolutionary, contextual, biopsychosocial approach. *Psychol Psychother Theory Res Pract*. 2019;92(2):164–89. <https://doi.org/10.1111/papt.12226>.
46. Hofmann SG. Cognitive factors that maintain social anxiety disorder: A comprehensive model and its treatment implications. *Cogn Behav Ther*. 2007;36(4):193–209. <https://doi.org/10.1080/16506070701421313>.
47. Johnson SL, Leedom LJ, Muhtadie L. The dominance behavioral system and psychopathology: evidence from self-report, observational, and biological studies. *Psychol Bull*. 2012;138(4):692. <https://doi.org/10.1037/a0027503>.
48. Tharp JA, Johnson SL, Dev A. Transdiagnostic approach to the dominance behavioral system. *Pers Individ Dif*. 2021;176:110778. <https://doi.org/10.1016/j.paid.2021.110778>.
49. Nettle D, Bateson M. The evolutionary origins of mood and its disorders. *Curr Biol*. 2012;22(17):R712–21. <https://doi.org/10.1016/j.cub.2012.06.020>.
50. Aderka IM, Weisman O, Shahar G, Gilboa-Schechtman E. The roles of the social rank and attachment systems in social anxiety. *Pers Individ Dif*. 2009;47(4):284–8. <https://doi.org/10.1016/j.paid.2009.03.014>.
51. Weisman O, Aderka IM, Marom S, Hermesh H, Gilboa-Schechtman E. Social rank and affiliation in social anxiety disorder. *Behav Res Ther*. 2011;49(6–7):399–405. <https://doi.org/10.1016/j.brat.2011.03.010>.
52. Wetherall K, Robb KA, O'Connor RC. Social rank theory of depression: A systematic review of self-perceptions of social rank and their relationship with depressive symptoms and suicide risk. *J Affect Disord*. 2019;246:300–19. <https://doi.org/10.1016/j.jad.2018.12.045>.
53. Gilbert P, McEwan K, Bellew R, Mills A, Gale C. The dark side of competition: How competitive behaviour and striving to avoid inferiority are linked to depression, anxiety, stress and self-harm. *Psychol Psychother Theory Res Pract*. 2009;82(2):123–36. <https://doi.org/10.1348/147608308X379806>.
54. Gilbert P. Evolutionary approaches to psychopathology: The role of natural defences. *Aust N Z J Psychiatry*. 2001;35(1):17–27. <https://doi.org/10.1046/j.1440-1614.2001.00856.x>.
55. West P. Health inequalities in the early years: is there equalisation in youth? *Soc Sci Med*. 1997;44(6):833–58. [https://doi.org/10.1016/S0277-9536\(96\)00188-8](https://doi.org/10.1016/S0277-9536(96)00188-8).
56. Forbes EE, Dahl RE. Pubertal development and behavior: hormonal activation of social and motivational tendencies. *Brain Cogn*. 2010;72(1):66–72. <https://doi.org/10.1016/j.bandc.2009.10.007>.
57. Quon EC, McGrath JJ. Subjective socioeconomic status and adolescent health: a meta-analysis. *Health Psychol*. 2014;33(5):433. <https://doi.org/10.1037/a0033716>.
58. Rahal D, Chiang JJ, Fales M, Fuligni AJ, Haselton MG, Slavich GM, et al. Early life stress, subjective social status, and health during late adolescence. *Psychol Health*. 2020;35(12):1531–49. <https://doi.org/10.1080/08870446.2020.1761977>.
59. Kessler RC, Berglund P, Demler O, Jin R, Merikangas KR, Walters EE. Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. *Arch Gen Psychiatry*. 2005;62(6):593–602. <https://doi.org/10.1001/archpsyc.62.6.593>.
60. Fehm L, Pelissolo A, Furmark T, Wittchen H-U. Size and burden of social phobia in Europe. *Eur Neuropsychopharmacol*. 2005;15(4):453–62. <https://doi.org/10.1016/j.euroneuro.2005.04.002>.
61. OECD. Education at a Glance 2020. 2020.
62. Allen NB, Badcock PB. The social risk hypothesis of depressed mood: evolutionary, psychosocial, and neurobiological perspectives. *Psychol Bull*. 2003;129(6):887. <https://doi.org/10.1037/0033-2909.129.6.887>.
63. Dunn JC, Whelton WJ, Sharpe D. Retreating to safety: Testing the social risk hypothesis model of depression. *Evol Hum Behav*. 2012;33(6):746–58. <https://doi.org/10.1016/j.evolhumbehav.2012.06.002>.
64. Gilbert P. Evolution and social anxiety: The role of attraction, social competition, and social hierarchies. *Psychiatric Clinics*. 2001;24(4):723–51. [https://doi.org/10.1016/S0193-953X\(05\)70260-4](https://doi.org/10.1016/S0193-953X(05)70260-4).

65. Hays NA, Bendersky C. Not all inequality is created equal: Effects of status versus power hierarchies on competition for upward mobility. *J Pers Soc Psychol*. 2015;108(6):867. <https://doi.org/10.1037/pspi0000017>.
66. Mattan BD, Kubota JT, Cloutier J. How social status shapes person perception and evaluation: A social neuroscience perspective. *Perspect Psychol Sci*. 2017;12(3):468–507. <https://doi.org/10.1177/1745691616677828>.
67. Henricks LA, Lange WG, Luijten M, van den Berg YH, Stoltz SE, Cillessen AH, et al. The longitudinal link between popularity, likeability, fear of negative evaluation and social avoidance across adolescence. *J Res Adolesc*. 2023. <https://doi.org/10.1111/jora.12833>.
68. Puts D. Human sexual selection. *Curr Opin Psychol*. 2016;7:28–32. <https://doi.org/10.1016/j.copsyc.2015.07.011>.
69. McNeil DW. Evolution of terminology and constructs in social anxiety and its disorders. *Social Anxiety*. Elsevier; 2010. p. 3–21.
70. Maner JK, Kenrick DT. When adaptations go awry: Functional and dysfunctional aspects of social anxiety. *Soc Issues Policy Rev*. 2010;4(1):111–42. <https://doi.org/10.1111/j.1751-2409.2010.01019.x>.
71. Li NP, van Vugt M, Colarelli SM. The evolutionary mismatch hypothesis: Implications for psychological science. *Curr Dir Psychol Sci*. 2018;27(1):38–44. <https://doi.org/10.1177/0963721417731378>.
72. Marmot M, Friel S, Bell R, Houweling TA, Taylor S, Health CSD. Closing the gap in a generation: health equity through action on the social determinants of health. *Lancet*. 2008;372(9650):1661–9. [https://doi.org/10.1016/S0140-6736\(08\)61690-6](https://doi.org/10.1016/S0140-6736(08)61690-6).
73. Marmot M, Bell R. Fair society, healthy lives. *Public Health*. 2012;126:S4–10. <https://doi.org/10.1016/j.puhe.2012.05.014>.
74. Peterson LE, Tsai AC, Petterson S, Litaker DG. Rural–urban comparison of contextual associations with self-reported mental health status. *Health Place*. 2009;15(1):125–32. <https://doi.org/10.1016/j.healthplace.2008.03.001>.
75. Lantz PM, Pritchard A. Socioeconomic indicators that matter for population health. *Prev Chronic Dis*. 2010;7:4.
76. Patel V, Burns JK, Dhingra M, Tarver L, Kohrt BA, Lund C. Income inequality and depression: a systematic review and meta-analysis of the association and a scoping review of mechanisms. *World Psychiatry*. 2018;17(1):76–89. <https://doi.org/10.1002/wps.20492>.
77. Buttrick NR, Heintzelman SJ, Oishi S. Inequality and well-being. *Curr Opin Psychol*. 2017;18:15–20. <https://doi.org/10.1016/j.copsyc.2017.07.016>.
78. Islam MI, Ormsby GM, Kabir E, Khanam R. Estimating income-related and area-based inequalities in mental health among nationally representative adolescents in Australia: The concentration index approach. *PLoS ONE*. 2021;16(9):e0257573. <https://doi.org/10.1371/journal.pone.0257573>.
79. Santiago CD, Wadsworth ME, Stump J. Socioeconomic status, neighborhood disadvantage, and poverty-related stress: Prospective effects on psychological syndromes among diverse low-income families. *J Econ Psychol*. 2011;32(2):218–30. <https://doi.org/10.1016/j.joep.2009.10.008>.
80. Lynch JW, Smith GD, Kaplan GA, House JS. Income inequality and mortality: importance to health of individual income, psychosocial environment, or material conditions. *BMJ*. 2000;320(7243):1200–4. <https://doi.org/10.1136/bmj.320.7243.1200>.
81. Buttrick NR, Oishi S. The psychological consequences of income inequality. *Soc Personal Psychol Compass*. 2017;11(3):e12304. <https://doi.org/10.1016/j.copsyc.2017.07.016>.
82. Pickett KE, Wilkinson RG. Income inequality and health: a causal review. *Soc Sci Med*. 2015;128:316–26. <https://doi.org/10.1016/j.socscimed.2014.12.031>.
83. Layte R. The association between income inequality and mental health: testing status anxiety, social capital, and neo-materialist explanations. *Eur Sociol Rev*. 2012;28(4):498–511. <https://doi.org/10.1093/esr/jcr012>.
84. Gupta AE, Huston AC. Depressive symptoms and economic outcomes of low-income women: a review of the social causation, social selection, and interactionist hypotheses. *Soc Issues Policy Rev*. 2009;3(1):103–40. <https://doi.org/10.1111/j.1751-2409.2009.01012.x>.
85. Ly M, Haynes MR, Barter JW, Weinberger DR, Zink CF. Subjective socioeconomic status predicts human ventral striatal responses to social status information. *Curr Biol*. 2011;21(9):794–7. <https://doi.org/10.1016/j.cub.2011.03.050>.
86. Stein DJ, Lim CC, Roest AM, De Jonge P, Aguilar-Gaxiola S, Al-Hamzawi A, et al. The cross-national epidemiology of social anxiety disorder: Data from the World Mental Health Survey Initiative. *BMC Med*. 2017;15(1):1–21. <https://doi.org/10.1186/s12916-017-0889-2>.
87. Curhan KB, Levine CS, Markus HR, Kitayama S, Park J, Karasawa M, et al. Subjective and objective hierarchies and their relations to psychological well-being: A US/Japan comparison. *Soc Psychol Personal Sci*. 2014;5(8):855–64. <https://doi.org/10.1177/1948550614538461>.
88. Schreier SS, Heinrichs N, Alden L, Rapee RM, Hofmann SG, Chen J, et al. Social anxiety and social norms in individualistic and collectivistic countries. *Depress Anxiety*. 2010;27(12):1128–34. <https://doi.org/10.1002/da.20746>.
89. Okawa S, Arai H, Sasagawa S, Ishikawa S-I, Norberg MM, Schmidt NB, et al. A cross-cultural comparison of the bivalent fear of evaluation model for social anxiety. *J Behav Cogn Ther*. 2021. <https://doi.org/10.1016/j.jbct.2021.01.003>.
90. Wilkinson RG. Health, hierarchy, and social anxiety. *Ann NY Acad Sci*. 1999;896(1):48–63. <https://doi.org/10.1111/j.1749-6632.1999.tb08104.x>.
91. Dall SR, Giraldeau L-A, Olsson O, McNamara JM, Stephens DW. Information and its use by animals in evolutionary ecology. *Trends Ecol Evol*. 2005;20(4):187–93. <https://doi.org/10.1016/j.tree.2005.01.010>.
92. McCullough EL, Miller CW, Emlen DJ. Why sexually selected weapons are not ornaments. *Trends Ecol Evol*. 2016;31(10):742–51. <https://doi.org/10.1016/j.tree.2016.07.004>.
93. Fraser B. Costly signalling theories: beyond the handicap principle. *Biol Philos*. 2012;27(2):263–78. <https://doi.org/10.1007/s10539-011-9297-8>.
94. Zahavi A. Mate selection—a selection for a handicap. *J Theor Biol*. 1975;53(1):205–14. [https://doi.org/10.1016/0022-5193\(75\)90111-3](https://doi.org/10.1016/0022-5193(75)90111-3).
95. Zahavi A. The cost of honesty (further remarks on the handicap principle). *J Theor Biol*. 1977;67(3):603–5. [https://doi.org/10.1016/0022-5193\(77\)90061-3](https://doi.org/10.1016/0022-5193(77)90061-3).
96. BliegeBird R, Smith E. Signaling theory, strategic interaction, and symbolic capital. *Curr Anthropol*. 2005;46(2):221–48. <https://doi.org/10.1086/427115>.
97. Berglund A, Bisazza A, Pilastro A. Armaments and ornaments: an evolutionary explanation of traits of dual utility. *Biol J Linn Soc*. 1996;58(4):385–99. <https://doi.org/10.1111/j.1095-8312.1996.tb01442.x>.
98. Cronk L. The application of animal signaling theory to human phenomena: some thoughts and clarifications. *Soc Sci Inf*. 2005;44(4):603–20. <https://doi.org/10.1177/0539018405058203>.

99. Sundie JM, Kenrick DT, Griskevicius V, Tybur JM, Vohs KD, Beal DJ. Peacocks, Porsches, and Thorstein Veblen: conspicuous consumption as a sexual signaling system. *J Pers Soc Psychol.* 2011;100(4):664. <https://doi.org/10.1037/a0021669>.
100. Spence M. Job Market Signaling. *Q J Econ.* 1973;87(3):355–74. <https://doi.org/10.1016/B978-0-12-214850-7.50025-5>.
101. Veblen T. *The Theory of the Leisure class.* New York: Penguin Books; 1899.
102. Connelly BL, Certo ST, Ireland RD, Reutzel CR. Signaling theory: A review and assessment. *J Manag.* 2011;37(1):39–67. <https://doi.org/10.1177/0149206310388419>.
103. Griskevicius V, Tybur JM, Sundie JM, Cialdini RB, Miller GF, Kenrick DT. Blatant benevolence and conspicuous consumption: when romantic motives elicit strategic costly signals. *J Pers Soc Psychol.* 2007;93(1):85. <https://doi.org/10.1037/0022-3514.93.1.85>.
104. Kraus MW, Keltner D. Signs of socioeconomic status: A thin-slicing approach. *Psychol Sci.* 2009;20(1):99–106. <https://doi.org/10.1111/j.1467-9280.2008.02251.x>.
105. Winegard B, Winegard B, Geary DC. The status competition model of cultural production. *Evol Psychol Sci.* 2018;4(4):351–71. <https://doi.org/10.1007/s40806-018-0147-7>.
106. Sweet E. Symbolic capital, consumption, and health inequality. *Am J Public Health.* 2011;101(2):260–4. <https://doi.org/10.2105/AJPH.2010.193896>.
107. Tricomi E, Rangel A, Camerer CF, O'Doherty JP. Neural evidence for inequality-averse social preferences. *Nature.* 2010;463(7284):1089–91. <https://doi.org/10.1038/nature08785>.
108. Dawes CT, Loewen PJ, Schreiber D, Simmons AN, Flagan T, McElreath R, et al. Neural basis of egalitarian behavior. *Proc Natl Acad Sci.* 2012;109(17):6479–83. <https://doi.org/10.1073/pnas.1118653109>.
109. Moav O, Neeman Z. Saving rates and poverty: The role of conspicuous consumption and human capital. *Econ J.* 2012;122(563):933–56. <https://doi.org/10.1111/j.1468-0297.2012.02516.x>.
110. Nishi A, Shirado H, Rand DG, Christakis NA. Inequality and visibility of wealth in experimental social networks. *Nature.* 2015;526(7573):426–9. <https://doi.org/10.1038/nature15392>.
111. Cristini H, Kauppinen-Räsänen H, Barthod-Prothade M, Woodside A. Toward a general theory of luxury: Advancing from workbench definitions and theoretical transformations. *J Bus Res.* 2017;70:101–7. <https://doi.org/10.1016/j.jbusres.2016.07.001>.
112. Donzé P-Y, Fujioka R. European luxury big business and emerging Asian markets, 1960–2010. *Bus Hist.* 2015;57(6):822–40. <https://doi.org/10.1080/00076791.2014.982104>.
113. Husic M, Cicic M. Luxury consumption factors. *J Fashion Mark Manag.* 2009. <https://doi.org/10.1108/13612020910957734>.
114. Han YJ, Nunes JC, Drèze X. Signaling status with luxury goods: The role of brand prominence. *J Mark.* 2010;74(4):15–30. <https://doi.org/10.1509/jmkg.74.4.015>.
115. Nelissen RM, Meijers MH. Social benefits of luxury brands as costly signals of wealth and status. *Evol Hum Behav.* 2011;32(5):343–55. <https://doi.org/10.1016/j.evolhumbehav.2010.12.002>.
116. Ruvio AA, Shoham A. Consumer arrogance: Scale development and validation. *J Bus Res.* 2016;69(10):3989–97. <https://doi.org/10.1016/j.jbusres.2016.06.004>.
117. Kapferer J-N, Valette-Florence P. Assessing levers of guilt in luxury consumption: an international perspective. *J Prod Brand Manag.* 2021. <https://doi.org/10.1108/JPBM-11-2020-3239>.
118. Hennighausen C, Hudders L, Lange BP, Fink H. What if the rival drives a Porsche? Luxury car spending as a costly signal in male intrasexual competition. *Evol Psychol.* 2016. <https://doi.org/10.1177/1474704916678217>.
119. Jiang M, Gao DG, Huang R, DeWall CN, Zhou X. The devil wears P rada: advertisements of luxury brands evoke feelings of social exclusion. *Asian J Social Psych.* 2014;17(4):245–54. <https://doi.org/10.1111/ajsp.12069>.
120. Bronner F, de Hoog R. Conspicuous leisure: The social visibility of cultural experiences. *Int J Mark Res.* 2021;63(3):300–16. <https://doi.org/10.1177/1470785319880715>.
121. Delhey J, Schneidert C, Steckermeier LC. Sociocultural inequalities and status anxiety: redirecting the spirit level theory. *Int J Comp Sociol.* 2017;58(3):215–40. <https://doi.org/10.1177/0020715217713799>.
122. Noll H-H, Weick S. Consumption expenditures and subjective well-being: empirical evidence from Germany. *Int Rev Econ.* 2015;62(2):101–19. <https://doi.org/10.1007/s12232-014-0219-3>.
123. Wu F. An examination of the effects of consumption expenditures on life satisfaction in Australia. *J Happiness Stud.* 2020;21(8):2735–71. <https://doi.org/10.1007/s10902-019-00161-3>.
124. Moldes O, Ku L. Materialistic cues make us miserable: A meta-analysis of the experimental evidence for the effects of materialism on individual and societal well-being. *Psychol Mark.* 2020;37(10):1396–419. <https://doi.org/10.1002/mar.21387>.
125. Azoulay R, Gilboa-Schechtman E. The scarring impact of status loss in social anxiety: An evolutionary perspective. *J Anxiety Disord.* 2022;90:102600. <https://doi.org/10.1016/j.janxdis.2022.102600>.
126. Blakemore S-J, Mills KL. Is adolescence a sensitive period for sociocultural processing? *Annu Rev Psychol.* 2014;65:187–207. <https://doi.org/10.1146/annurev-psych-010213-115202>.
127. Oay EB, Heimberg RG. Social media use, social anxiety, and loneliness: A systematic review. *Computers Hum Behav Rep.* 2021;3:100070. <https://doi.org/10.1016/j.chbr.2021.100070>.
128. Feinstein BA, Hershberg R, Bhatia V, Latack JA, Meuwly N, Davila J. Negative social comparison on Facebook and depressive symptoms: Rumination as a mechanism. *Psychol Pop Media Cult.* 2013;2(3):161. <https://doi.org/10.1162/003355399556151>.
129. Rauch SM, Strobel C, Bella M, Odachowski Z, Bloom C. Face to face versus Facebook: Does exposure to social networking web sites augment or attenuate physiological arousal among the socially anxious? *Cyberpsychol Behav Soc Netw.* 2014;17(3):187–90. <https://doi.org/10.1089/cyber.2012.0498>.
130. Brosnan SF, de Waal FB. Evolution of responses to (un) fairness. *Science.* 2014;346(6207):1251776. <https://doi.org/10.1126/science.1251776>.
131. André JB, Baumard N. The evolution of fairness in a biological market. *Evolution.* 2011;65(5):1447–56. <https://doi.org/10.1111/j.1558-5646.2011.01232.x>.
132. Axelrod R, Hamilton WD. The evolution of cooperation. *Science.* 1981;211(4489):1390–6. <https://doi.org/10.1126/science.7466396>.

133. Sloane S, Baillargeon R, Premack D. Do infants have a sense of fairness? *Psychol Sci.* 2012;23(2):196–204. <https://doi.org/10.1177/0956797611422072>.
134. Yamamoto S, Takimoto A. Empathy and fairness: Psychological mechanisms for eliciting and maintaining prosociality and cooperation in primates. *Soc Justice Res.* 2012;25(3):233–55. <https://doi.org/10.1007/s11211-012-0160-0>.
135. Fehr E, Schmidt KM. A theory of fairness, competition, and cooperation. *Q J Econ.* 1999;114(3):817–68. <https://doi.org/10.1162/003355399556151>.
136. Blake PR, McAuliffe K, Corbit J, Callaghan TC, Barry O, Bowie A, et al. The ontogeny of fairness in seven societies. *Nature.* 2015;528(7581):258–61. <https://doi.org/10.1038/nature15703>.
137. Dawes CT, Fowler JH, Johnson T, McElreath R, Smirnov O. Egalitarian motives in humans. *Nature.* 2007;446(7137):794–6. <https://doi.org/10.1038/nature05651>.
138. Starmans C, Sheskin M, Bloom P. Why people prefer unequal societies. *Nat Hum Behav.* 2017;1(4):0082. <https://doi.org/10.1038/s41562-017-0082>.
139. Norton MI, Ariely D. Building a better America—One wealth quintile at a time. *Perspect Psychol Sci.* 2011;6(1):9–12. <https://doi.org/10.1177/1745691610393524>.
140. Di Martino S, Prilleltensky I. Happiness as fairness: The relationship between national life satisfaction and social justice in EU countries. *J Community Psychol.* 2020;48(6):1997–2012. <https://doi.org/10.1002/jcop.22398>.
141. McKenzie K, Whitley R, Weich S. Social capital and mental health. *Br J Psychiatry.* 2002;181(4):280–3. <https://doi.org/10.1192/bjp.181.4.280>.
142. Almedom AM. Social capital and mental health: An interdisciplinary review of primary evidence. *Soc Sci Med.* 2005;61(5):943–64. <https://doi.org/10.1016/j.socscimed.2004.12.025>.
143. Brosnan SF, Tone EB, Williams L. The evolution of social anxiety The evolution of psychopathology. Berlin: Springer; 2017. p. 93–116.
144. Grupe DW, Nitschke JB. Uncertainty and anticipation in anxiety: an integrated neurobiological and psychological perspective. *Nat Rev Neurosci.* 2013;14(7):488–501. <https://doi.org/10.1038/nrn3524>.
145. Carleton RN, Collimore KC, Asmundson GJ. “It’s not just the judgements—It’s that I don’t know”: Intolerance of uncertainty as a predictor of social anxiety. *J Anxiety Disord.* 2010;24(2):189–95. <https://doi.org/10.1016/j.janxdis.2009.10.007>.
146. Teale Sapach MJ, Carleton RN, Mulvogue MK, Weeks JW, Heimberg RG. Cognitive constructs and social anxiety disorder: Beyond fearing negative evaluation. *Cogn Behav Ther.* 2015;44(1):63–73. <https://doi.org/10.1080/16506073.2014.961539>.
147. Moscovitch DA. What is the core fear in social phobia? A new model to facilitate individualized case conceptualization and treatment. *Cogn Behav Pract.* 2009;16(2):123–34. <https://doi.org/10.1016/j.cbpra.2008.04.002>.
148. Tudge JR, Mokrova I, Hatfield BE, Karnik RB. Uses and misuses of Bronfenbrenner’s bioecological theory of human development. *J Fam Theory Rev.* 2009;1(4):198–210. <https://doi.org/10.1111/j.1756-2589.2009.00026.x>.
149. Blöte AW, Miers AC, Heyne DA, Westenberg PM. Social anxiety and the school environment of adolescents. *Soc Anxiety Phobia Adolesc Development.* 2015. https://doi.org/10.1007/978-3-319-16703-9_7.
150. Firth J, Torous J, Stubbs B, Firth JA, Steiner GZ, Smith L, et al. The “online brain”: how the Internet may be changing our cognition. *World Psychiatry.* 2019;18(2):119–29. <https://doi.org/10.1002/wps.20617>.
151. Chang Y, Durante KM. Why consumers have everything but happiness: An evolutionary mismatch perspective. *Curr Opin Psychol.* 2022. <https://doi.org/10.1016/j.copsyc.2022.101347>.
152. Li NP, Yong JC, Van Vugt M. Evolutionary psychology’s next challenge: solving modern problems using a mismatch perspective. *Evol Behav Sci.* 2020;14(4):362. <https://doi.org/10.1037/ebs0000207>.
153. Baumeister RF, Robson DA. Belongingness and the modern schoolchild: On loneliness, socioemotional health, self-esteem, evolutionary mismatch, online sociality, and the numbness of rejection. *Aust J Psychol.* 2021;73(1):103–11. <https://doi.org/10.1080/00049530.2021.1877573>.
154. Saad G. The marketing of evolutionary psychology. *J Bus Res.* 2020;120:485–91. <https://doi.org/10.1016/j.jbusres.2019.03.048>.
155. Ketelaar T, Ellis BJ. Are evolutionary explanations unfalsifiable? Evolutionary psychology and the Lakatosian philosophy of science. *Psychol Inq.* 2000;11(1):1–21. https://doi.org/10.1207/S15327965PLI1101_01.
156. Shackelford TK, Liddle JR. Understanding the mind from an evolutionary perspective: an overview of evolutionary psychology. *Wiley Interdiscip Rev Cogn Sci.* 2014;5(3):247–60. <https://doi.org/10.1002/wcs.1281>.

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