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Mating games: cultural evolution and sexual selection

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Abstract. In this paper, we argue that mating games, a concept that denotes cultural practices characterized by a competitive element and an ornamental character, are essential drivers behind the emergence and maintenance of human cultural practices. In order to substantiate this claim, we sketch out the essential role of the game's players and audience, as well as the ways in which games can mature and turn into relatively stable cultural practices. After outlining the life phase of mating games – their emergence, rise, maturation, and possible eventual decline – we go on to argue that participation in these games (in each phase) does make sense from an adaptationist point of view. The strong version of our theory which proposes that all cultural practices are, or once were, mating games, allows us to derive a set of testable predictions for the fields of archaeology, economics, and psychology.

Introduction

Only a theory that can encompass cultural evolution, biological evolution, and the interplay between both can genuinely be called a gene-culture co-evolutionary theory (Feldman and Laland 1996; Smith 2000). This paper attempts to provide a building block for such a 'grand unifying theory of human culture' by exploring, and elaborating upon, the idea that a substantial part of human culture can be interpreted and studied as 'mating games,' viz. as forms of intra- and intersexual competition between individuals of our species. Unpacking this idea will show that the emergence, maturation, and possible eventual decline of cultural practices does make sense from a Darwinian perspective. The first section discusses the general relevance of games and sexual selection for the genesis, evolution, and understanding of culture, outlining along the way a number of working hypotheses. The second section discusses the essential roles of players and audience, and elucidates how the specific factors that attract (a) players and (b) audiences to these games can be placed within a Darwinian framework. The third section looks at what role the innovation, change, and stabilization of cultural practices has within our mating game theory. The last section discusses two different versions of the theory. We conclude with a set of testable predictions for the fields of archaeology, economics, and psychology, derived from the mating game theory.

Culture as a mating game

It is noteworthy that when Darwin introduced the concept of sexual selection, in '*The Descent of Man*,' he immediately applied it to the evolution of human culture. Apparently, Darwin saw cultural elements like clothing, music, and dance as the result of selection operating on traits that enhance an individual's mating success (Darwin 1871). Geoffrey Miller, who has most recently taken up this idea again, argues that each culture develops its own set of courtship rituals (Miller 2000), and that these rituals help the individuals of a particular culture either to *show* their fitness to potential mates or to *evaluate* the fitness of potential mates. Miller speculates, for instance, that story-telling, poetry, visual arts, sports, humour, and even philosophy are to be understood as strategies to obtain and/or show status in our culture.

We shall limit ourselves for the time being to this subset of cultural practices, which we call cultural mating games. In the conclusion, we will discuss the relative size of this subset with respect to the entire set of cultural practices. But now we should like to specify what we mean by mating games, and introduce two working hypotheses based on two essential characteristics. The first is that many cultural practices have a *competitive element*. Participating and/or excelling in cultural activities may impress members of the other sex (intersexual selection) or it may help one to attain a higher position in the hierarchy of one's own sex (intrasexual selection). We are aware that distinguishing between two forms of sexual selection is a tricky issue: "Intersexual and intrasexual selection are conceptually related in that mate choice preferences exerted by one sex should influence the resources over which intrasexual competition occurs in the other sex." (Buss 1988, 616). It is well-known that status and its correlates (resources, longevity, good genes, etc.) increase an individual's attractiveness as a mate, and that the intimate entanglement of intrasexual and intrasexual selection is very strong in our species due to *Homo sapiens*' pervasive tendency to ritualize agonistic behaviour (Eibl-Ebesfeldt 1979).

Now it is essential to stress that we understand the competitive element as the *result* of, and not as the *motive* for, participating in the game. As a consequence, not all mating games are openly competitive. Our first working hypothesis, then, is that mating games produce a rank order because of their inherent competitiveness.

It is important to note that the survival value of mating games is relatively limited. More often than not, mating games *lack clear utility*: the importance of mating games in quantitative terms, in terms of *costs*, that is, is overshadowed by its 'residual' quality (Lancy 1980). The costs include, for example, the opportunity costs: the costs accrued from lost fitness benefits that might have been achieved by a savvier use of the resources. The time, energy, and financial resources weightlifters spend on their training cannot be spent on other, more useful activities. While the lack of utility would seem at first sight to rule out many cultural practices as mating games – after all, tools and other aspects of technological culture are clearly useful – we shall argue later on that these

practices may also have evolved from mating games (see also Mithen 2003). These possible exceptions aside, most cultural activities are purely *ornamental*, as if this sort of culture transcended the immediate needs of life. Our second working hypothesis, then, is that mating games are ornamental in nature, at least at a certain stage in their development.

The ornamental character of mating games aligns our theory with costly signaling theory (Zahavi 1975). Indeed, we claim (1) that the costs of participating in mating games provide accurate information about the player's qualities and (2) that engaging in cultural mating games is costly, at the very least because of the opportunity costs. Our approach to cultural mating games is informed by the description, in Maynard-Smith and Harper, of cost-added signals (1995). Players signal a certain quality, even if the qualities signaled by excelling at various games are probably quite different. With no pretensions at being exhaustive, we suggest that the need to signal qualities that are predictive of inclusive fitness – physical health (football), strength (weightlifting), intelligence (chess), fertility (beauty contests), and vigor (running) – may have spawned a variety of cultural mating games. Those qualities that may be attractive to potential partners pursuing a more specific mating strategy, such as loyalty (supporting a sports team), conscientiousness (collecting stamps), and innovativeness (starting new cultural games), may have been at the origin of a different set of games.

Examples of what we consider to be mating games are sports, intellectual games, hobbies, certain professions, and also currents in literature, art, fashion; even science and religion might be seen as mating games. There are many different ways of categorizing these games: some contests are overt, some masked; there are games played by a population as a whole and there are niche games; there are games of chance (poker, lottery, dicing), of skill (running, chess, soccer), of simulation (role playing), of vertigo (bungee jumping, mountaineering) – to mention just a few of the best-known categorizations (see, e.g., Caillois 1961). Most categories encompass games in countless numbers, a diversity suggestive of the fact that the great majority of cultural games are not 'hard-wired' in our nervous system. Indeed, it is likely that humans have some cultural adaptations, but these adaptations are flexible and require major input from the social and cultural environment. To give just one example, sexual selection may have designed a musical intelligence, but jazz, minimalism, and pop are clearly modern creations and not the (direct) result of biological selection pressures (Gardner 1985). In other words, the specific content and rules of cultural games are usually invented, learned, or transformed by more or less intelligent individuals. Such games are to a large extent a matter of transmitted culture (Tooby and Cosmides 1992). Still, one can expect fitness to be an influencing factor in (1) the preference players and public show for a certain game, (2) the further development of already existing games, and (3) the invention of new games. After all, one may assume that many of these games are culturally invented indicators of bodily and psychological fitness (Miller 2000; Ohler and Nieding 2005).

Like all courtship rituals in the animal kingdom, cultural mating games are determined by the mating preferences of the opposite sex, and by the sample tactics the opposite sex uses to gather information about prospective mates (Widemo and Saether 1999). There are, however, some important differences between courtship rituals in non-human animals and typically human cultural mating games. Some of these differences, including the huge difference in variety between humans and other species, can be attributed to the diversity of mating preferences and sample tactics in humans. In the first place, human mating strategies are highly conditional (Gangestad and Simpson 2000): environmental conditions determine the adaptive value of mating preference and sample tactic. As an example, pooled comparison ('looking for the optimal mate') is preferable in stable and safe environments, whereas threshold-based rules ('looking for a good-enough mate') tend to yield higher fitness in unsafe environments (Gibson and Langen 1996). This seriously complicates the study of human mating games given the fact that even in one society different individuals occupy different environmental niches. Thirdly, in human societies, prestige and hierarchical rank are correlated but not necessarily identical (Freese and Cohen 1973; Henrich and Gil-White 2001). Fourthly, *Homo sapiens*' environment of evolutionary adaptedness (EEA) in some respects differs dramatically from humans' current environment, and this may lead to a mismatch between our present conditions and our evolved mating preferences and strategies. Fifthly, both sexes in our species are choosy (Buss and Schmitt 1993), which means that members of the both sexes must oscillate between playing and observing. The fact that women also engage in game-playing activities (mating games) is also noteworthy, because it reveals that the runaway model of sexual selection – the so-called 'sexy sons'-hypothesis – is less likely to apply to human cultural activities than the 'good genes' model. After all, runaway sexual selection applies primarily to male traits: a 'sexy daughter'-effect can only be very weak (Anderson 1994). Furthermore, pure runaway selection usually promotes strong sexual dimorphism, and to the extent human males and females both take part in cultural activities, such a model fits the facts less well than a good genes model of sexual selection. Last but not least, humans are particularly skilled at deception and manipulation (Trivers 1991; Rue 1994), so that many of the signals sent by the cultural players might be meant to manipulate prospective partners and/or rivals rather than to inform them correctly. Indeed, even genuinely informative games require some form of manipulation, since they have to attract players and audience. The next section looks at this kind of seduction.

Everyone's a winner

The winner of a mating game competition usually gains in status, and, on average, enhancing one's status is beneficial for one's reproductive success (Cummins 2005). Hence, since biological selection has built our neuroendocrinal

and cognitive-behavioural systems to pursue winning and to avoid losing, it is baffling from a Darwinian point of view why it is that many players enter into competitions they are bound to lose. Considering that the cost of losing seems huge, one would expect people (1) to avoid participation in games they cannot play well enough to win, and (2) to be able to detect such games. The upshot is that a Darwinian theory of mating games must be able to construct models capable of explaining why someone would be interested in playing games he/she cannot but lose.

It has to be acknowledged that it is not easy to predict the outcome of most mating games, and this can lead to mistakes in two ways. The first is that players may overestimate their chances because they lack a realistic image of the game, of their future rivals, or of their own skills. The point of note, however, is that entering may seem a mistake when considered from the limited perspective of one game only, but an intelligent choice when considered from broader, long-term perspective: entering many games may lead to more success than entering no game at all, even when the odds of every single game are against the player. In other words, unfounded self-esteem can sometimes be more adaptive than well-founded self-depreciation (Heckhausen and Gollwitzer 1987). The second is that potential players can be manipulated by the likely winners of the game into believing that 'they have everything a good player should have' or that 'the game is much easier than it looks.'

That said, a player may sometimes want to enter a game even though he/she knows that the odds are against him/her. This is the case when the costs of losing are much lower than the benefits of winning. It is, in fact, in the interest of skilled players to reduce the costs of losing because this lowering of the stakes (1) attracts less skilled players and (2) reduces their own risks in the unlikely event that they should lose. Of course, minimizing the costs tends also to lower the benefits, all else being equal. This means that many games probably evolve towards an optimum somewhere between the minimum cost for losers and the maximum benefit for winners.

There are many different ways of minimizing the costs of losing. Generally, most cultural mating games are highly ritualized 'fights' in which individuals fight each other with gifts (*potlatch*, e.g., Boone 1998), arguments (philosophy, science), sounds (music), cards (bridge), and so on. If you lose these ritualized fights, you only lose status or prestige.

One strategy for making a game attractive to 'losers' is to reduce the absolute costs of losing, another is to reduce the relative costs of losing by augmenting the (apparent or real) benefits of *participation* itself. This strategy can be split up into at least 10 different substrategies:

(1) Winners can exploit people's tendency to conformism in order to convince them that participating in a game is a precondition for social acceptance. Evidently, this substrategy can be interpreted also as a means of reducing the relative cost of losing – losing is bad for the individual's reproductive success, but ostracism is worse (O'Connor 2000; Richerson and Boyd

2005). The threat of ostracism, incidentally, has consistently been shown to increase cooperation to the maximum level in economic games (Ciyabuguma et al. 2005). For low status individuals, getting no attention at all may be worse than getting negative attention. Zadro et al. (2005) show, for example, that being the target of an argument (i.e., negative attention) is less stressful than being the target of ostracism (i.e., no attention).

(2) People often imitate high status individuals under the notion that such imitation raises one's chances of acquiring the skills that lead to success, even if the exact causes for the success of high status individuals are oblique (Richerson and Boyd 2005). This prestige bias explains why many individuals succumb to the temptation of participating in cultural games, even though they have neither the skills nor the wherewithal necessary to play the game successfully.

(3) Playing a cultural game usually helps one to develop, and possibly even master, the skills necessary to win that game in the future. Participating in a contest can sometimes be simply a form of training for future contests. Although the adaptive role of play as a practice-for-the-future is less straightforward than common intuition suggests (Bekoff and Byers 1981; Spinka et al. 2001), recent evidence highlights the facilitating role of play in the transmission of information (Virvou et al. 2005).

(4) The skills gained in a game can also be useful in other contests, so that even if you can never win the game you are playing, it may still prove beneficial to continue playing. Swimming, for example, makes your body attractive, even if you lose every swimming contest you ever enter.

(5) Research into the dynamics of playing music has shown that playing tends to strengthen bonds with other participants (Hagen and Bryant 2003). This means that for some players losing is just the price they have to pay for a valuable social network.

(6) Reciprocal altruism can result in a tacit contract: 'I'll play your game if you'll play mine.' In other words, participating in games you are not particularly good at may attract participants for the games you excell at.

(7) In some instances, the mere fact of being allowed to compete in a game is itself a fitness indicator. Coming in last at the Olympic steeple chase is better for your prestige than not having taken part in the race at all.

(8) Being a good loser may advertise certain psychological qualities (e.g., sportsmanship, equanimity, determination) that may be of interest to potential mates or social allies in the public. While some female members of the audience will no doubt aim to mate with the winner of the game ('cads'), other audience members will instead set their eyes on other potential long-term mates ('dads') (Kruger et al. 2003).

(9) The willingness to lose can be a costly signal and thus beneficial (Zahavi 1975). For example, losing a lot of money at a casino may seem silly and useless, but it is an honest signal of wealth.

(10) Entering a game is often an excellent means of evaluating the fitness of others playing the same game.

The last substrategy, which makes entering a contest almost identical to being part of the game's audience, raises the following question: why would one want to be part of the audience? This might at first sight seem obvious: watching members of the other sex compete helps you make a good partner choice because it allows you to evaluate the players' fitness. This means that it is in the players' interest to offer the audience valid *and* easy-to-grasp clues of (heritable) fitness (Trivers 1972). While that may indeed be the case when players and audience are of different genders, from a Darwinian point of view it is less obvious why some individuals love to watch a contest between individuals of their own sex. That some men in the audience cheer other men on to victory and excellence is almost a rebuttal of Darwinism, and yet, that is precisely what happens all the time. There are certainly plenty of reasons why people love to attend mating games such as concerts and tennis matches: identification with the player, the aesthetic qualities of the performance, patriotism, and so forth. The challenge for theories of cultural evolution is to frame these motives within a Darwinian theory. Why would it be beneficial for one's reproductive success to attend a mating game?

(1) It is not only members of the opposite sex who have an interest in gaining valuable information about the players' fitness:

a. Since the outcome of the contest bears on the intrasexual hierarchy, watching the game can also be beneficial for individuals of the players' sex: the outcome of a game tells you which player is the best ally, or worst enemy, to have.
b. Some may use this information to steer the partner choice of their close kin (e.g., children and siblings). This is especially relevant given the lack of reproductive freedom in many human societies (Kasser and Sharma 1999).

(2) Attending a contest helps one gather information about technical aspects of the contest, which in turn helps one to improve as a player. Indeed, in many games, audience, and players share preferences, as, for instance, in the political game (van Zoonen 2004).
(3) Mating games, because they are often social activities, are an excellent occasion to form and strengthen affective bonds with other members of the audience. And strong alliances with others are necessary to the acquisition and maintenance of a high social rank (Cummins 2005).

Attending a cultural activity, in short, is not as ill-advised at it may seem at first sight. The costs of watching a game are often negligible, making even the smallest benefits attached to it suffice as an evolutionary explanation. However, the costs seem to increase spectacularly once individuals start supporting one of the players involved in the game. Since every player of one's own sex is a potential rival, the logical prediction would be for one to hate the winner, not cheer him or her on.

One might challenge the claim that individuals of the same sex are each other's sexual rivals, since this seems to be true only for small-scale societies.

In modern, large-scale societies the chances of meeting the top players and competing with them are rather slim. David Beckham, Brad Pitt, and Bill Clinton are not really our sexual rivals. However, as Aiello and Dunbar (1993) have pointed out, the social EEA was a small-scale society. In other words, the fact that Brad Pitt and other top players are not really our sexual rivals does not mean that one does not perceive them as sexual rivals. Linda Mealey has forwarded the hypothesis that anorexia is the result of a mismatch between (a) women's evolved tendency to compete for male attention and (b) the 'unnatural' female models featured by today's mass media that makes winning the competition virtually impossible for most 'ordinary' women (Mealey 2000).

What Darwinian factors mitigate the rivalry?[1] Probably the same factors that underpin the well-documented phenomenon that the success of a player or team increases not only the status of this player or team, but also the status of the supporters.

(4) If you already have an affective bond with one of the players, supporting him is in your own interest, because his victory will only make him a better ally. Moreover, supporting a player may signal loyalty to this player.
(5) Supporting close kin may enhance one's inclusive fitness. Studies have shown that sometimes cultural kin terms ('my team is my family') may be used as a tool to manipulate adaptive tendencies to support biological kin (Cronk 1999).
(6) Reciprocity can be a crucial factor, specially in small-scale societies: 'I support you when you play your game, you'll support me when I play mine.' Probable loser's participation in solo games ('one-to-one games') might also be explained by a social network rationale if the loser's opponents are part of his or her social network.
(7) Some mating games can signal both mate quality and coalition quality. Music and dance, in Hagen and Bryant's hypothesis (2003), serve these two functions. This means that supporting one's team sometimes permits meaningful cooperative relationships between groups, since supporting the team or player from your group signals to other groups that your group is not plagued by internal conflicts. The benefits of such a coalition may outweigh the costs of supporting an in-group rival, specially since in-group rivalry is often very costly (Alexander 1987). Of course, this social network rationale applies only to team games.
(8) Supporting a player of your own sex can make this player unreachable for most members of the other sex, as most highly praised individuals usually 'play in another league' (or another niche) than those who praise him/her. Moreover, men as well as women demand sexual exclusivity (Gangestad and Simpson 2000), while very successful players are less likely to be faithful (Townsend and Levy 1990).

[1]This riddle is to a large extent similar to the Darwinian paradox of excessive altruism in humans (Fehr and Fischbacher 2003).

(9) Supporting a player/team can itself be a mating game in which loyalty, commitment, perseverance, and several other important qualities (fitness indicators) are tested and shown or evaluated. We expand upon this characteristic in the next section.

Most of the listed factors have as their basis the idea that the players in mating games send signals worth receiving/encoding. The quality and honesty of signals determine not only the benefits to both the players and the audience, they also determine the success of the game itself. It is reasonable to expect that a game that is in some measure beneficial to winners, losers, and audience will be more stable (survive longer in the present form) than a game with detrimental effects to any one of the parties involved. The next section discusses the factors that contribute to the stability, change, and innovation of mating games.

The rise and fall of mating games

Cultural variation is important, as people with different cultural backgrounds behave differently in similar environments (Richerson and Boyd 2005). Not only do they have different values, they also eat different things and play different (mating) games (Roberts et al. 1959). Lacrosse, a ball game originally developed by Native Americans in the 15th century, is now quite popular among college students in the USA and Canada, though only marginally popular in the rest of the world; Sumo wrestling is largely confined to Japan; only a few tribes in Afghanistan play the strange game of Buzkashi; and many cultures have their own favourite board game. Although, historically, most pre-modern sports were a form of religious worship, modern sports usually lack any reference to the transcendental (Guttman 1978). In the arts, cultural, and historical diversity is even more striking. People who claim to recognize another culture's art as art often fail to see the point or beauty of the work or performance (Darwin 1871; Maher 1976). And modern subcultures are good indicators that a variety of artistic expressions and standards coexist within one culture. Over time, some of these subcultures are assimilated into the mainstream, others go extinct, and still others remain marginal.

The vast literature on the origins of inter- and intracultural differences leave us in no doubt that geography, natural resources, individual creativity, and a plethora of historical contingencies contribute to the generation of new cultures in general and of new (mating) games in particular. Still, it is seems likely that biological evolutionary forces interact with these factors to produce cultural innovation, diversity, and stability. What, then, are these forces? And how do they influence the evolution of mating games?

In general, one would predict that an individual will enter a new mating game (a) if the perceived cost-benefit ratio, taking into account the switch costs,[2] of the 'new' game is better for the individual's reproductive success than the perceived cost-benefit ratio of the 'old' one, or (b) if the player believes he/she can reap the cumulative benefits of simultaneously played mating games. Because of the differences between our modern environment and the EAA, the perceived cost-benefit ratio sometimes differs from the actual ratio, so that modern individuals cannot always accurately assess the cost-benefit ratio of their own reproductive success. In short, we should understand the evolutionary costs and benefits as referring (a) to situations that on average had negative (costs) or (b) positive (benefits) effects on the reproductive success of our ancestors.

It goes without saying that an individual's search for a new mating game does not automatically result in some form of cultural innovation. Most societies are not lacking for choice in mating games, which makes 'game-hopping' between existing games always a possibility. Cultural innovation needs pioneers, people who invent new games[3] that stand a chance of surviving the starting phase because they are good enough games to attract both players and audience. While the new game may initially give some information about the players' fitness, it is usually far from optimal in terms of measuring skills or fitness: it produces an impure or 'noisy' hierarchy. Our mating game theory suggests that if the game does not have the potential to optimize its informative value, it will go extinct. This does not mean, however, that all the noise will eventually be banned from the game; some noise may be required to attract (less skilled) players (*supra*).

Reducing randomness ('luck') in a game is probably one of the best ways to optimize its informative value. Almost every implicit and explicit rule of a game is meant to reduce the luck-component. In other words, the evolution of a game's rules is directed at achieving as high a correlation as possible between the fitness of the players and their chances to win the game (Miller 2000). In large-scale societies, there are numerous optimized games, many of which test different fitness indicators more or less accurately. In Western societies, for instance, one finds stand-up comedy, beauty contests, jazz, various athletic disciplines, tennis, soccer, ballet, etc. But not all of these games are equally successful if the game's success is directly proportional to (a) the fitness-relevancy of the game, and (b) the audience's ability to decode the signals sent by the players. In other words, the more informative, honest, and transparent a game is, the higher its popularity will be. A game that tests *accurately* and *comprehensibly* several mental (intelligence, perseverance, courage, ...) and

[2]A 'fitness-valley' may separate being an experienced player of game X and being a naive player of game Y, even if an experienced player of game Y enjoys a better cost-benefit ratio than an experienced player of game X. Switching from game X to game Y may require some sort of 'surplus' on the part of the player.

[3]www.guinnessworldrecords.com illustrates persuasively the human tendency to start ornamental and competitive games.

physical skills (strength, litheness, speed, ...) is bound to be a success. Unfortunately, very transparent games are not always very informative ones, just as very informative games are often difficult to understand. Many games, consequently, have to find a balanced combination of informativeness and transparency.

Players and audience are essential for a game to be successful, that is, for it to survive as a game and for it to be fitness-enhancing for players and audience. But, beyond a minimal threshold, the game's number of players and audience is not perfectly correlated with its success as a mating game. In other words, games can be very successful, even though they have only a relatively small audience. After all, human mating strategies and human mating preferences are highly conditional: some people maximize the number of sexual contacts (*r-strategy*), and others restrict themselves only to one sexual partner with high fitness and high parenting qualities (*k-strategy*) (Belsky et al. 1991; Gangestad and Simpson 2000). The latter will probably look for a highly informative mating game with little transparency, though in this case the lack of transparency is an asset because it raises the search costs, thus guaranteeing that the audience will consist almost exclusively of VFPs (Very Fit People). Differently put, games need not always compete with each other, provided, that is, that they are played in different (sub-)niches, by different players, and for different audiences.

We can further illustrate this point with a short and tentative sketch of the differences between 'male' and 'female' games. Although we have noted above that in humans both sexes are choosy, the existence of important cross-sex differences both in the choosiness and in the criteria of choice have to be acknowledged. These sex-differences are probably reflected in game-playing behaviour. Trivers (1972) has already suggested that because in our species the male sex invests less in offspring, males will compete more vigorously for access to strongly investing women. Hence, if cultural activities are mating games, one can expect male cultural activities to be more competitive than games primarily played by women. Moreover, the qualities sought by one sex are most likely the qualities advertised in the games played by the other sex. Cross-cultural research has indicated that men value physical attractiveness (a cue for health) in potential partners more than women do. Conversely, female preference for kind and understanding males (a cue for willingness to invest in offspring) exceeds the male preference for potential partners with these traits (Buss and Schmitt 1993). The upshot is that men will be proportionally more engaged in the writing of poetry, while women will rather spend their time, energy and resources on beauty contests. Women will read more poetry than men do, while the audience of beauty contests will be primarily male. This also means that poetry and beauty contests do not have to compete with each other.

Still, there are two reasons why competition between games is ubiquitous. The first is that some games are played in the same, or a highly similar, niche. The second is that potential players have only a limited time to engage in all possible games. Such competition between games can sometimes be determined by factors related to the above-mentioned optimal balance. Constraints on

optimization, for example, may prove fatal to some games. However, there are ways of rendering a mating game relatively immune to competition, thus stabilizing it as a successful mating game. We can categorize these ways under two headings: *panem* and *circenses* (the Roman 'bread and circuses'). The *circenses* category of mating games acquired stabilization because of its entertainment value; the *panem* because of its useful byproducts.

a. Circenses

Meta-mating games depend on other mating games. Being the best (smartest, most dedicated, prettiest, funniest) supporter (fan, art critic, Maecenas, gambler) only makes sense if there are players for you to support. Your support for the players, because it is inevitably also a support for the game, is a factor which increases the viability of the game. Hence, the symbiosis of mating games and meta-mating games: their association is advantageous both to players and audience.

Meta-mating games originate in the game's audience. For the mating game to survive, the meta-mating game has to attract new players as well as a new audience. The players and the audience of the meta-mating game may differ substantially from the original game's players and audience, since the meta-mating game usually tests other fitness indicators and provides different information. Moreover, the meta-mating game may in the long run alter the original mating game, for instance by generating money for the players of the original mating game. This of course adds an economic surplus value to the benefits already attached to excelling in the original mating, and may even change a player's motive for participating in the game in the first place. Players of the original mating game can now attract, because of the money, members of the other sex who are less interested in the qualities of an excellent player of the original game, but who are very interested in signals of material wealth. Losing becomes less dramatic because participating provides new benefits. This process manages to solve one of the threats to the viability of the original mating game, namely finding players who lack the skill and wherewithal to win.

The meta-mating game can render the original game immune to competition from other games, but only to a certain extent. Since meta-mating games compete with one another, the defeat of a meta-mating game can also bring down the game it is built on.

Popular sports and their audiences are obvious examples of *circenses*. Both social realms, the game and the meta-game, bear the characteristics of mating games, and the extent to which a sport can turn into a business seems tightly correlated to its audience size. That said, nothing prevents a game from eventually fading away as better games appear on the scene.

b. Panem

Economic surplus value is also attainable without the help of meta-mating games. The surplus value – the direct, though not necessarily intentional,

side-effect of the mating game – can after a while become the main motive for participating in the game. When this happens, the mating game has been transformed into a collective survival strategy. This exaptation will then determine the further evolution or development of the cultural activity. In one scenario, the mating game may keep some of its original functions after the transition to *panem*, although the quality that it signals may change. Mating games that follow this path are likely to become part of the educational system, and excelling at them may therefore also start signaling conformism, zeal, persistence, and so on.

A possible example of *panem* is architecture. Although it may have developed as a costly signal to advertise one's fitness (Neiman 1997), once it was seen to be useful for sheltering the members of the architect's community, the architectural survival strategy exapted the architectural mating game. And it was through this partial 'exaptation' (architecture still functions as a costly signal), the cultural activity of architecture guaranteed its own survival.

Discussion and conclusion

Culture is a very 'complex whole' (Cronk 1999) in that nearly every cultural activity combines survival value with status value. We have tried in this paper to contribute to our understanding of human cultural practices, their huge variety and dynamism, by refining and elaborating upon the concept of mating game. Our contribution offers a way of linking Darwinian processes in cultural evolution theories with first order (biological) Darwinian processes. In the body of the paper we proposed a number of fitness-enhancing factors to explain why people invent new games, play existing games, enter games they are bound to lose, or watch and support others play. An important question must now be raised: how might this theory stimulate further conceptual and empirical work? One such way is by proposing general empirical strategies based on our theory, and another is by looking at the areas for future research that may be inspired by the current work.

By achieving this double task, our theory goes beyond a cheap 'just-so-story' (Brandon 1990) because, first of all, it is firmly grounded in Darwinian theory, recent theorizing included; secondly, because it dovetails common intuition and empirical evidence; and thirdly, because it provides a broad explanation for that wide range of phenomena that we call 'culture.' But exactly how widely does our theory apply? The strong version of our theory claims that all cultural activities are, or once were, mating games; the weak version claims that all cultural practices with a competitive and ornamental aspect are mating games. The weak version allows for the view that some cultural practices, particularly those with a competitive and ornamental aspect, originated as survival strategies but turned into mating games only later on, while other cultural practices never did turn into mating games and thus remain outside the mating game

subset altogether. Hunting technology, for example, seems to support only the weak version of our theory: it has clear survival benefits and therefore it may have originated in the need for game rather than in the need to signal qualities. However, such practices can be used simultaneously to enhance one's status (Mithen 2003). Hunting is a means of getting food, yes, but it is probably also, and frequently at that, a way for males to show-off (Hawkes and Bliege Bird 2002). The strong version of our theory implies that hunting indeed originated as play and was subsequently exapted as a highly useful means of ensuring calory intake. Farming is a similar example. While at first sight farming seems clearly to have originated as a response to climatic conditions (Fagan 2004), the strong version of our model suggests rather that farming, science, and indeed all economic activities originated as mating games. An important implication of our theory is that the ornamental phase may in fact be essential to human economic development, as a way of bridging the gap between the emergence of an essentially useless activity and the moment when that activity actually becomes useful. Put it this way: the first attempts to tame sheep may have been a sign of insight into animal psychology, an important precondition for successful hunting, and not a conscious attempt to cultivate livestock on the part of people who could afford not to eat all the meat at their disposal.

The strong version of the mating game theory is admittedly speculative and counterintuitive. However, the strong version outruns the weak version as a heuristic device because it leads to various testable predictions and hypotheses. We will conclude this paper with a preliminary sketch of these hypotheses, the first set of which deals with the origin of cultural practices.

Archeological research will find our model useful when looking at signs of competition in cultural practices normally thought to be straightforward economic activities. There is evidence that dogs were domesticated before cattle (Fagan 2004), and we predict that flowers were cultivated before wheat. Farming, that is, originated as play and was exapted in times of environmental stress (Fagan 2004). Archeology may also find evidence of very low economic surplus of certain artifacts or objects that have been considered as weapons or tools. Maybe stones and hand axes were originally used as play objects rather than as weapons or cutting devices.

Our model is useful to the field of economics, where it might shed new light on organization structure and income inequality. Trotsky was probably wrong when he said that competitive sports could be used to keep competitive 'instincts' out of the economy (Collier 1998). These 'competitive instincts,' far from being domain-specific, tend instead to contaminate every human activity. In other words, organizations may benefit from allowing the emergence of many parallel mating games in the workplace, mating games in which the winners of the job-related games may be the losers of unrelated ones. Such reciprocity enhances stability and increases loyalty on the part of the employees. Further, our model predicts that in *panem* there is a perennial tension between the original aim (signaling the quality of the game) and the exapted economic activity (obtaining resources, creating something socially

useful). In scientific research, for instance, basic research is closer to the aims of the original mating game because one of its defining characteristics is that it is not directly useful for society (that is, it is ornamental). This leads to the prediction that basic scientific researchers will have greater prestige but lower incomes than their colleagues, applied researchers. For *circenses*, the opposite relation should hold: higher status should be directly related to income, since those with the best skills attract the largest audience, which in turn generates higher revenues. Lastly, we suggest that our model is useful to psychology, because it allows psychologists to make verifiable predictions concerning the more proximate mediators of cultural evolution. Androgen and serotonin levels, for instance, may regulate the search for new mating games, while hormone levels are themselves the result of complex gene–environment interactions. Manning's finding that men with a low 2D:4D strive more adamantly for status than men with a high 2D:4D (Manning 2002) allows for the prediction that highly skilled people will be more likely to participate in mature mating games, whereas people with low skills will be more inclined to play games that are not yet mature. We predict, further, that this difference will be larger for low 2D:4D men than for high 2D:4D men. And if we refine our pool still further and control only for intelligence or artistic skill, we predict that low 2D:4D people will prefer to engage in fundamental scientific research or elite culture (because of the prestige), whereas high 2D:4D people will prefer applied scientific research or mass culture (because of the economic surplus).

To conclude, we suggest that our model, which ties cultural to biological evolution, provides a necessary building block in our efforts to achieve a grand and unifying Darwinian cultural theory. While we realize that many gaps still need to be filled, we believe the model is specific enough to allow testable predictions in a range of disciplines.

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