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CHAPTER 9

(Ir)rationality in action: do soccer players and goalkeepers fail to learn how to best perform during a penalty kick?

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Abstract: This chapter discusses penalty kicks in soccer, interpreted within the framework of behavioral economics. We present two behaviors of professional soccer players during penalty kicks that seem nonoptimal, and possibly indicate biases in decision making. We ask whether, despite the huge incentives involved in professional soccer and the possibility of learning through feedback from the outcomes of previous penalty kicks, goalkeepers and penalty kickers are not optimizing their actions. We suggest that they do indeed learn to optimize, but have a different utility function; goalkeepers are not solely interested in minimizing the chances of the goal, and kickers are not solely interested in maximizing these chances.

We believe that, in general, in cases where decision makers have the ability to learn through feedback about the outcome of their actions but exhibit behavior that seems nonoptimal, it is possible that they do optimize, but that their utility function is different from the one assumed. We propose that such decision makers' behavior be reconceived as "socially rational," in the sense that their social environment seems to be incorporated into their utility functions. Finally, the concept of "socio-emotional rationality" is suggested to account for possible implications in future studies of motion–cognition interactions.

Keywords: social rationality; behavioral economics; soccer; penalty; decision making

Introduction

In their message to the participants of the interdisciplinary workshop on Motion and Cognition, Raab et al. (2008) stated that the broadest goal of the workshop is "to gain a better understanding of individuals' decision-making processes when complex movements are part of the behavior," and "to provide insights into decision making that can also be extended to other situations… unlike the "standard" economic utility models." Furthermore, they stated that the rationale of the workshop is, among others, to find out whether "models in the judgment and decision-making area in cognitive science" are "applicable to real actions in real environments," and ask whether "as a consequence of knowing the underlying mechanisms of choice, can training schedules

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or other instructional aspects be altered as one of the long-standing goals to improve performance?''

In their message, Raab et al. (2008) requested that our team discuss the implications of our (applied) decision-making research conducted in sport (which is closely related to the field of economics) on the ''feedback of decisional outcomes for subsequent situations,'' that is, how feedback from states of the environment result from the produced action. In essence, it was stated that among all issues discussed in the workshop, ''this question will be perhaps the most concerned with interactions between motor and cognitive systems, because… responses and adaptations to this feedback by both the motor system and the cognitive system result in learning.''

For the past decade, our team has been investigating different aspects of penalty kicks in soccer. In this chapter, we will briefly present two of these studies and demonstrate how the behavior of both goalkeepers and kickers during penalty kicks in soccer can be used to address some of the above-mentioned issues, when theorized and analyzed within the framework of behavioral economics. We will also discuss some possible broader implications for the question of human rationality.

Behavioral economics

One of the popular topics in economics in the 2000s is behavioral economics. Not long ago, most economists did not consider adding insights from psychology and/or sociology to economic analysis a worthwhile endeavor, and consequently, behavioral economics was a peripheral area that received very little attention. Recently, however, the field has gained more recognition, and today psychological and sociological factors, such as decision-making biases, are believed to influence economic behavior in many important ways (for review see Rabin, 1998; Kahneman, 2003). For example, awarding the John Bates Clark Medal (considered to be the second highest prize in economics after the Nobel Prize) to economist Matthew Rabin in 2001, and the Nobel Prize in economics to the psychologist Daniel Kahneman (and Vernon Smith) in 2002, demonstrates the increased recognition of behavioral economics as an important research area.

Traditional economic theory (e.g., Samuelson and Nordhaus, 2004) assumes that people have well-defined preferences, and these can be represented by a utility function. People then maximize their utility, subject to budget constraints. Moreover, it was usually assumed that economic agents are selfish and care only about their own well-being or the well-being of their own household. In models that added uncertainty to the environment, maximizing utility was replaced by maximizing expected utility, using the probabilities of the different possible future states.

While this model of economic decision making was helpful in many areas (including sports; e.g., see Leeds and von Allmen, 2005; Fort, 2006; Eschenfelder and Li, 2007), and still continues to be a standard model in economics, it was also shown in numerous experiments and empirical studies that often decision makers deviate from these assumptions in important ways, and that this might affect not only the individual, but even firm strategy and market outcomes as well (e.g., see Azar, 2004a). Consequently, in recent years many economic models have become more flexible about the assumptions they make regarding economic behavior, for example, allowing the economic agent to be concerned about social norms (Azar, 2004b, 2005) or to be inequality averse (Fehr and Schmidt, 1999).

There are several major reasons why people might behave differently from the assumed behavior of traditional economic theory. One reason is that they are prone to biases in their judgment and decision-making processes, and therefore they may not optimize correctly. For example, people might have systematic biases in their perception of probabilities (Gilovich et al., 2002), or they may consider relative price differences even when only absolute price differences matter (denoted ''relative thinking,'' see Azar, 2007). Another reason is that the task may be too complex for people to accomplish, in particular when time constraints and stress might prevent the performer from accurately processing all the information and reaching optimal decisions (Payne and Bettman, 2004). Finally, the

preferences of people do not always match those assumed in traditional economic theory. Evidence for this has been found, not only in economics, but also in finance (Glaser et al., 2004) and accounting (Kotchetova and Salterio, 2004).

In this chapter, we propose that when decision makers exhibit behaviors that seem nonoptimal, despite having enough opportunities to practice the task, receive feedback about the outcome, and thus learn to perform it better, it should be carefully examined whether the preferences of the decision makers are different from the ones assumed. More specifically, we suggest that while it seems at first that the only thing that should matter to soccer players during penalty kicks is whether a goal is scored or not, they in fact also care about how the outcome came about and how it is perceived, and this could lead to what seems at first to be nonoptimal behavior. In what follows, we demonstrate how our research on penalty kicks in soccer is related to this observation, and how behaviors that seem nonoptimal at first can be not only rationalized in the derogatory Freudian sense but actually reconceived as optimal and thus rational. Then, we explain why these behaviors consequently exist, despite the ample learning and feedback that professional goalkeepers and players have on previous penalty kicks.

Penalty kicks in soccer

The topic of judgment and decision making under uncertainty has recently attracted the attention of sport/exercise psychologists (Bar-Eli and Raab, 2006). Penalty kicks in soccer create a simple but interesting real-life example of a decision-making task under uncertainty. According to Palacios-Huerta (2003), the time it takes the ball to get from the penalty mark to the goal is about 0.3 s; this would imply that because of the short distance between the ball and the goal, and because of the high speed at which the ball is kicked, the goalkeeper usually cannot afford to wait until he/she sees clearly in what direction the ball is kicked. Therefore, the goalkeeper has to make a decision whether to jump to one side or to stay in the center, and this decision is made at about the same time that the kicker chooses where to direct the kick.

The goalkeeper has to choose whether to jump to the right or the left, or to stay in the center, in order to minimize the risk of a goal being scored, under conditions of uncertainty regarding the direction and height of the ball. The goalkeeper may use his/her knowledge of the directional distribution of penalty kicks in general, the past behavior of the kicker, and cues that might be obtained from the kicker's behavior and approach of the ball, to help him/her decide to which side to jump, if at all. Similarly, the kicker has to decide how to take the shot, facing uncertainty regarding what the goalkeeper will do.

Needless to say, the importance of the goalkeeper's and kicker's performances in professional soccer during penalty kicks is crucial. Not only does the outcome of the game often depend on the goalkeeper's and kicker's performances, but also the issue of the huge amounts of money involved can be raised: teams can make large amounts of money by winning and climbing to the next stage of a tournament, players receive bonuses for successful games, and the kicker's and goalkeeper's reputation and, thus, future earnings also depend on their performance, to give just a few examples. Since players in top clubs earn hundreds of thousands and often millions of dollars annually (see Kupfer, 2006 for review), it is obvious that the kicker's and goalkeeper's performances (e.g., in penalty kicks) have highly significant monetary implications.

Consequently, the penalty kick represents a decision problem with major incentives, making it very intriguing to determine whether expert players — who are encouraged through hefty financial rewards to do their best during the few seconds of a penalty kick — deviate from rational decision making. Numerous studies have examined cognitive processes such as anticipation, cue utilization, and response time of goalkeepers during penalty kicks (e.g., Morris and Burwitz, 1989; McMorris et al., 1993; Williams and Burwitz, 1993; McMorris et al., 1995; McMorris and Colenso, 1996; Savelsbergh et al., 2002, 2005). However, the question of whether goalkeepers

and kickers act optimally or reveal biased decision making is still under-researched. Accordingly, Bar-Eli et al. (2007) investigated this problem, and found that goalkeepers jump to their right or left in 94% of the penalty kicks, although given the distribution of kicks, it is optimal for the goalkeeper to stay in the center. Bar-Eli and Azar (2009), although not directly addressing the issue of biased decision making, found that the most difficult penalty kicks to stop are the ones that reach the upper third part of the goal, and nevertheless only 13% of penalty kicks reach this area. We discuss these two findings in more detail below.

Goalkeeper behavior

In Bar-Eli et al. (2007), the behavior of goalkeepers during penalty kicks was examined. The authors collected video recordings of 311 penalty kicks from actual games in top male soccer leagues and championships worldwide, and asked three judges to determine, using a diagram of the goal's area, to which part of the goal the ball was kicked, to which direction the goalkeeper jumped (if at all), and whether he/she stopped the ball. After excluding kicks on which there was significant disagreement among the judges and kicks that missed the goal frame, 286 remained and were used for the analysis. The main statistics in the data are summarized in Table 1. (It should be noted that when we mention right or left, it is from the goalkeeper's perspective; therefore, a kick to the left actually means that the kicker shot the ball to his/her right, and vice versa.)

As Table 1 shows, about 29% of the kicks reached the central third of the goal, but the goalkeeper chose to stay in the center only in about 6% of the cases. This behavior is even more puzzling and striking when we take into account that the chances of the goalkeeper to stop a kick when his/her choice matches the direction of the kick is much higher in the center than at the sides (60% vs. 25–30%; Table 1). Consequently, as the table suggests, the chances of stopping a kick are higher when the goalkeeper stays in the center than when he/she jumps to one of the sides. Nevertheless, goalkeepers almost always (in 94% of the kicks) jump to the right or left instead of staying in the center.

Bar-Eli et al. (2007) suggest that the reason for this nonoptimal behavior is the so-called ''action bias.'' Because the norm is that goalkeepers should ''do something'' (i.e., jump) during penalty kicks, norm theory (Kahneman and Miller, 1986) implies that a goal scored yields feelings for the goalkeeper that are worse following inaction (staying in the center) than following action (jumping), leading to a bias for action. The more frequently investigated ''omission bias'' (a bias in favor of inaction; see Ritov and Baron, 1990, 1992, 1995) was reversed in that study, because the norm among goalkeepers was to act rather than to choose inaction. A survey conducted with 32 top professional goalkeepers supported the claim that jumping is the norm and that a goal scored caused worse feelings for the goalkeeper if it was the result of his decision to stay in the center.

Traditional economic theory would imply that the goalkeeper's behavior is optimal when it minimizes the chances of the other team to score

Table 1. Penalty kick outcomes

	Left	Center	Right
Goalkeeper's choice[a]	49.3%	6.3%	44.4%
Goalkeeper's chances to stop the kick overall[b]	14.2%	33.3%	12.6%
Goalkeeper's chances to stop if the goalkeeper and kicker choose the same direction[c]	29.6%	60.0%	25.4%
Kicker's choice[d]	32.2%	28.7%	39.2%

[a]Presents the percentage of cases in which the goalkeeper chose to jump left, right, or stay in the center.
[b]Presents the fraction of kicks that were stopped following each of the goalkeeper's possible actions, regardless of the kick's direction.
[c]Presents the fraction of kicks that were stopped when both the goalkeeper and the kicker chose this direction (i.e., the goalkeeper chose the correct direction — the one that matched the kick direction).
[d]Presents the distribution of the kicks' direction.

a goal. This suggests that the goalkeeper should stay in the center and not jump as long as the kickers do not change their kicking strategy. However, from the goalkeeper's perspective, the documented behavior of almost always jumping might be optimal if his/her utility function includes not only the score outcome (goal or not), but also other ingredients (e.g., if he/she felt worse following a scored goal when he/she did not jump than when he/she jumped); indeed, the survey of the top goalkeepers mentioned above supports this idea. It is also possible that observers of the goalkeeper, including soccer managers who can affect the goalkeeper's career and earnings in the future, are biased in their evaluation of the goalkeeper's actions. That is, they may view a goalkeeper who stays in the center and gets a goal as acting less professionally than a goalkeeper who jumps to one of the sides and gets a goal. If that is the case, then this also justifies, from the goalkeeper's perspective, the decision to almost always jump, even though this does not maximize the team's expected score (because it does not minimize the chances of a goal).

One could even go a step further and make the conjecture that even from the team's perspective, minimizing the chances to get a goal is not the entire component of the utility function. Teams are also economic organizations, and, as such, they want to attract fans to their games. While fans are more attracted by successful teams, they may also be concerned with how the team is playing, and may view ''heroic jumps'' to save a penalty kick as more attractive than a goalkeeper who just stays in the center. Therefore, it is possible that the goalkeeper's behavior, which at first seems irrational, is rational not only from his/her own perspective, but also because it matches the team's preferences.

This discussion may suggest why, despite the huge monetary incentives that are involved in professional soccer, and despite the fact that the highly experienced goalkeepers included in our study have had ample opportunities for learning and receiving feedback about the prospects of their possible actions, the goalkeepers still only rarely choose the optimal action, that is, the one that minimizes the chances of a goal — to stay in the center. According to this reasoning, it is not that they do not learn how to optimize their behavior despite having learning and feedback opportunities; their behavior is consistent with preferences that are different from merely minimizing the chances of a goal, and the goalkeepers' behavior might indeed optimize their utility, once these preferences are taken into account.

Kicker behavior

Bar-Eli and Azar (2009) used the set of penalty kicks reported in Bar-Eli et al. (2007) but augmented it by also considering the height of the kick and not only its horizontal direction. As opposed to Bar-Eli et al. (2007), who focused on the goalkeeper's strategy and whether he/she exhibited decision-making biases, Bar-Eli and Azar (2009) examined the optimal strategy for the kicker in penalty kicks. They found that approximately 13% of the kicks reached the upper third of the goal, 30% the central part, and 57% the lower part. None of the kicks kicked to the upper part was stopped, compared to 13% stopping chances of the kicks to the central part and 20% to the lower part. Bar-Eli and Azar concluded that the optimal shooting strategy is to aim the ball to the upper part (in particular to the upper two corners), and that with proper training, the missing rates should be low enough to justify applying such a strategy.

The major factor that may deter kickers from kicking to the upper part of the goal is probably that this would increase the chances of missing the entire goal frame. However, the scoring chances of a flat kick, which is shot to the lower third of the goal, are at most 80% (according to the data, the goalkeeper has about a 20% chance to stop a ball that is shot to the lower-third inside the goal frame, but there is also an additional probability that the kick will be shot to the goalpost, or miss the goal frame altogether). Therefore, if the chances of a kick that is kicked to the upper third to miss the goal frame are lower than 20%, this strategy should be considered better than kicking to the lower third. It seems reasonable that, with

proper training, a less than 20% missing rate can be achieved; yet, we see kickers shooting much more often (over four times more frequently) to the lower part than to the upper part of the goal (obviously, there is also the alternative of kicking to the central third, but to simplify the discussion we are focusing on the upper and lower parts).

Once again, at first glance these results are puzzling. Kickers have ample opportunity to practice penalty kicks, to practice various alternative shots, and to receive feedback (e.g., by seeing whether they and/or their colleagues scored a goal or not) and learn how to improve their performance of these kicks. Why, despite this, and even though they have huge incentives to perform penalty kicks optimally in real games, do they rarely shoot to the upper part of the goal, where the goalkeeper's chances to stop the ball are negligible?

This question can probably be answered by the preferences of kickers, which are not necessarily only to maximize the chances to score a goal (even though from the team's perspective this should be the most important issue). For example, it is possible that from the kicker's perspective, missing the goal frame is considered worse than kicking a ball that the goalkeeper succeeds in stopping. The reason could be that in the first case it is clear that the missed goal is solely the kicker's fault, while in the second case the outcome (of no goal) may also be attributed (e.g., by different observers) to the goalkeeper's ability to stop the kick, and not only to the kicker's inability to kick well. Consequently, kickers might avoid shooting to the upper part. If kickers' behavior is indeed motivated not only by maximizing the chances of scoring a goal but also by other preferences, it should not be surprising that learning does not solve this seemingly nonoptimal behavior. It is not that the kickers do not learn how to optimize their performance in kicking penalties; they do optimize, but not a classic ''economic'' utility function (i.e., maximizing the chances of scoring). Instead, their utility function also reflects their significant disutility from missing the goal frame, which is higher than their disutility from a kick that the goalkeeper stops.

Social rationality

We present two behaviors of professional soccer players during penalty kicks that seem at first to be nonoptimal, and possibly indicate biases in decision making. One is that goalkeepers almost always jump to one of the sides, even though staying in the center is the strategy that minimizes the chances of a goal, given the distribution of the direction of kicks. The second is that kickers shoot to the upper third of the goal in only 13% of the cases, even though with proper training the chances of scoring such a kick are extremely high (i.e., this is the action that maximizes the chances of scoring a goal).

The question we ask is whether it is *reasonable*, despite the huge incentives involved in professional soccer, and despite the possibility of receiving feedback from the outcomes of previous penalty kicks (including ones in training) and consequently of learning, that soccer players will still not optimize their actions. We suggest that the answer might be that the players are reasonable, but they are reasonable in the sense that they optimize a different utility function than what was expected — the goalkeepers are not only interested in minimizing the chances of a goal being scored, and the kickers are not only interested in maximizing these chances of scoring.

In the case of goalkeepers, their utility also depends on whether they have jumped or not — they feel worse when a goal is scored if they did not jump than if they did jump. The reason for this might be that it is considered a more professional and correct action to jump (perhaps because this is what goalkeepers are expected to do in penalty kicks), or that goalkeepers jump because they want to appear as though they are trying hard to stop the ball; in sports, trying your best is an important value. Similarly, in the kickers' case, their behavior can be utility maximizing if they view missing the goal frame as a worse outcome than shooting a kick that the goalkeeper stops.

The interaction between the kicker and the goalkeeper can be described as follows: both the kicker and goalkeeper know quite well that the hardest areas for the goalkeeper to stop a penalty are the two upper corners of the goal

(Bar-Eli and Azar, 2009); that is, the optimal strategy for the kicker would be to shoot the ball to one of the two upper corners accurately. In this case, no matter what the goalkeeper does — the outcome of the kick would depend (almost) only on the kicker's performance. However, because of the kicker's utility function, which includes the perception of missing the goal frame as being a worse outcome than shooting a kick that the goalkeeper will eventually stop, the kicker prefers not to shoot to the upper corners. As a result, an interaction between the kicker and the goalkeeper takes place, because in most of the goal's areas (except for the two upper corners), the outcome of the kick will depend on the performance of both the kicker and the goalkeeper; this interaction can be best described in game-theoretical terms (e.g., Chiappori et al., 2002; Palacis-Huerta, 2003).

Because of this interaction or game between the kicker and the goalkeeper, an analysis of goalkeepers' behavior and possible decision-making biases — particularly the action bias (see Bar-Eli et al., 2007), and our above argument concerning the goalkeeper's possible different utility function (i.e., one that includes also their will to appear as trying hard to stop the ball) are both relevant. However, in reference to the major principles of motor control and learning (Schmidt and Lee, 2005), we believe that with sufficient and proper training of kicking penalties to the top corners of the goal (i.e., according to the most updated training principles; e.g., see Blumenstein et al., 2007 for review), the kickers' percentage of success in performing such kicks could be substantially increased, resulting in a goal being scored regardless of the goalkeepers' performance (because it is nearly impossible to stop a penalty kick shot to the upper two corners). Therefore, only the kickers' ''irrationality'' enables the kicker–goalkeeper game, as well as the consequent ''irrational'' behavior of goalkeepers, to take place.

The more general lesson we propose is that in cases where we observe decision makers who receive feedback about the outcome of their actions and thus have the ability to learn, and yet exhibit behavior that seems nonoptimal, one should carefully consider their assumed utility function. It is possible that the decision makers do optimize, but they optimize a utility function that is different from the one assumed, and therefore it might seem, incorrectly, that they behave irrationally and do not maximize utility.

A concept that is closely related to this lesson is that of ''social rationality.'' More specifically, in his seminal book, Gigerenzer (2000, p. 202) strongly challenges the idea that ''formal axioms and rules of choice can define rational behavior without referring to factors external to choice behavior,'' that is, that such axioms and rules can be imposed a priori as context-independent, general purpose yardsticks of rationality (see Chapter 10: Getting around: making fast and frugal navigation decisions, for further treatment of rationality). In line with other studies (e.g., Simon, 1986; Elster, 1990; Sen, 1993), he argued that ''these principles are incomplete as behavioral norms in the sense that their normative validity depends on the social context of the behavior, such as social objectives, values, and motivations.'' Without taking into account the social context, they are limited, confusing, and insufficient for defining rational behavior.

To demonstrate this idea, Gigerenzer (2000) used, among others, the phenomenon of ''probability matching'' (for reviews see Gallistel, 1990; Vulkan, 2000), according to which even after many rounds in an experiment (and therefore an ample opportunity for learning), as the decisions become more rational (i.e., choosing the option that more often has the higher probability of success), people still occasionally choose the non-optimal action. This is irrational if people only try to maximize their earnings in the experiment, which is the usual assumption in experimental economics. But if people's utility also depends on other factors, such as how boring the experiment is, and if it is more interesting for people to participate in an experiment where occasionally one chooses something different and does not always perform the same action, then it might be rational and utility maximizing for the participant to occasionally choose the option with the smaller probability of success, even though this might decrease the participant's expected earnings. As Gigerenzer (2000, p. 206) puts it, ''the maximizing

principle does not capture the distinction between the individual in social isolation and in social interaction… Whether an organism performs in isolation or in the context of other organisms can determine, among other things, whether maximization is entailed as an optimal choice rule'' (e.g., for evolutionary reasons; see Gallistel, 1990).

Viewed from this perspective, the goalkeepers and penalty kickers in our studies may be defined as ''socially rational'' in the sense that their social environment seems to be incorporated into their utility functions. In other words, social factors such as spectators, team-mates, and the coach (for review see Jowett and Lavallee, 2007), whose perception by the athletes was found to have a substantial effect on their performance (Bar-Eli, 1997), may play a major role in understanding the utility functions of penalty kickers (e.g., ''I don't want my miss — if it occurs — to be attributed by my spectators/team-mates/coach only to my inability, and therefore, I'll avoid shooting to the upper part of the goal'') and goalkeepers (e.g., ''I want to present myself to my observers as more professional — i.e., as someone who actively tries hard to do something — and therefore, I'll always jump''). Indeed, self-presentational considerations were found to be crucial in explaining people's behavior in physical activity contexts (Martin-Ginis et al., 2007), with individuals' mental representations of significant others substantially affecting the cognitive processes which underlie judgment and decision making in sport (Eccles and Tenenbaum, 2007).

Beyond social rationality: psychophilosophical considerations

Performance is defined as ''goal-directed behavior'' (e.g., by action theory; see Frese and Zapf, 1994; Schack and Hackfort, 2007). In order to maximize performance, athletes usually attempt to optimize something — be it, for example, their movement (Schack and Bar-Eli, 2007) or their arousal state (Gould and Carson, 2007). Thus, the pursuit of excellence in sport requires athletes to achieve performance ''maximization through optimization'' — a principle that is central among the major aspects of human rationality (Bar-Eli et al., 1999, 2006). Moreover, sport psychology has been provided with rational models, such as the Bayesian approach (for a review see Tenenbaum and Bar-Eli, 1993), and/or optimization aims derived from the domain of operations research in management science (Mehrez et al., 2006; Sinuany-Stern et al., 2006), which can be used to aid in optimizing the decision makers' thought processes required for performance maximization.

Such models reflect rationality in its instrumental sense, which has to do with the effectiveness of one's application of means towards the accomplishment of a certain goal (Weber, 1919/1946). Instrumental rationality and/or reasoning are reflected, for example, in the current literature on expert sport performance (for review see Starkes and Ericsson, 2003), and on the professionalization of managerial processes in organized elite sport (Slack and Parent, 2006). One might argue that in principle ''social rationality'' reflects an instrumental conception of rationality, with the utility function of both the goalkeeper and the penalty kicker being more complex than just to score or to stop the ball (i.e., maximizing chances of scoring as opposed to minimizing chances of a goal being scored). From the standpoint of the goalkeeper, it is preferred to have the goal scored while trying virtuously to stop the ball by jumping, than to have a goal scored while merely standing straight and effortlessly in the middle of the goal frame, because it is believed that an athlete must at least try to perform with power and grace. Similarly, from the standpoint of the kicker, the negative value of kicking the penalty totally out of bounds (i.e., a full miss of the goal frame) is a much worse outcome than kicking a penalty kick which is stopped by the goalkeeper, because it is believed that an athlete should prefer a solid effort (even if unsuccessful) to a complete failure which might even be perceived as shameful.

However, by modifying the utility function in order to be in line with the instrumental conception of reason, one misses the deeper ramifications of the abovementioned example for understanding the connection between human reason, emotion, decision making, and action. In many facets of human life, it is not only the

outcome that matters; but also how (i.e., by which route) the outcome was reached: for example, how active or passive was the agent, what were the agent's intentions, and what did the agent actively do (or refrain from doing) in order to reach the specific outcome. What one *did* and what one *did not* do in order to reach the outcome can be more significant than the outcome itself. The point is that human beings are not just utility-maximizing consequentialists; rather, emotions, social relations, and environmental considerations play an important role in people's decisions and actions. Thus, to drive the point home, within a loaded emotional situation, where pride and money are at stake and tension is high, the goalkeeper is an athlete and is expected to perform as an athlete. The goalkeeper is also a member of a team that has been making a tremendous effort for their fans and other stakeholders. As such, beyond maximizing a certain result per se, the goalkeeper is expected behave as an athlete and represent his/her entire team. As such the goalkeeper has to put up a fight and make a serious effort at stopping the penalty kick.

The ''trolley problem'' is an ethical thought experiment which might be used to clarify this matter; it was first introduced by Foot (1978, reprinted in 2002), and later richly elaborated upon by Thomson (1985) and Unger (1996). The trolley problem has also been a significant feature in Greene's (Greene, 2004; Greene et al., 2001) neuroscientific approach to questions of rational decision making. The relevance of the trolley problem to the current issue is not in the kind of situation it describes, but that by means of this moral dilemma we can demonstrate that our judgment and decision-making process takes into account more than just the optimal outcome.

According to the original version of the trolley problem suggested in 1978 (see Foot, 2002), you are driving a runaway trolley that is headed for five people who will be killed if it proceeds on its present course. The only way to save them is to hit a switch that will turn the trolley onto an alternate track where it will kill one person instead of five. Should you turn the trolley in order to save five at the expense of one? Most people say yes.

An alternative version of the trolley Problem (Thompson, 1985) is called the ''footbridge dilemma.'' As before, a trolley threatens to kill five people. You are standing next to a very fat stranger on a bridge. Your only way to stop the trolley is to push him over the bridge onto the track, killing him but saving five others. Should you proceed? Most people say no.

Though the outcome of the two cases can be similar, attempts to find relevant moral distinctions between these two cases, in order elucidate the rationale behind the agents' decision-making process, have traditionally focused on the agent's intention: in the first case one does not intend harm toward anyone and harming is just a side effect. Greene (2004), in taking a neuroscientific approach to the trolley problem, examined the brain's response to such decisions using functional magnetic resonance imaging (fMRI). His findings were that in cases where the dilemma was of a more personal nature, such as the footbridge dilemma, where one's decision involved a more active role of authorship, then the decision process involves a more social-emotional decision process. In contrast, if the dilemma was of a more impersonal nature, it involved a more cognitive decision process (Greene, 2004). More specifically, when participants considered personal moral dilemmas, the medial prefrontal cortex, posterior cingulate/precuneus, and superior temporal sulcus/temperoparietal junction exhibited increased activity, but when participants considered impersonal moral dilemmas, ''cognitive'' brain areas associated with abstract reasoning and problem solving exhibited increased activity. Thus, this study distinguished between judgments based on cognitive processes and judgments based on emotional processes, which enables us to suggest an extension of the very meaning of human rationality.

Conclusion: towards socio-emotional rationality

In the introduction to this chapter, we briefly summarized the broadest goal and the rationale of the workshop, as presented by Raab et al. (2008). We believe that our abovementioned two studies on penalty kicks in soccer successfully demonstrated

how behaviors of both goalkeepers and kickers in this situation can be used to address some of the major issues raised by Raab et al. (2008), when analyzed and theorized within the framework of behavioral economics. Gigerenzer's (2000) concept of "social rationality" seems to be adequate in capturing the behavior of goalkeepers and kickers during penalty kicks in soccer, mainly because it enables the incorporation of these actors' social environment into their respective utility functions. Although in principle this can be presented as an extended version of the "instrumental rationality" concept, by manipulating and extending the utility function, this way of capturing the goalkeeper's and kicker's behavior misses the deeper ramifications of the abovementioned example for understanding the connection between human reason, emotion, decision making, and action.

We suggest that in order to conceive better the relationship between motion and cognition in terms of the connections among psychology, economics, and sport, a concept of human rationality should be used, which will go beyond social rationality in the instrumental sense. In line with our discussion above, we suggest that the concept of "social rationality" be extended to include not only the social and environmental context but also emotional elements pertaining to the agent's character and role. Emotions have been of increasing interest to sport/exercise psychologists (e.g., Vallerand and Blanchard, 2000; Hanin, 2007), for example within the action theory (e.g., Kuhl, 1994; Schack and Hackfort, 2007) and the psychophysiological approach (e.g., Blumenstein et al., 2002; Hatfield and Kerick, 2007). We propose a concept of "socio-emotional rationality," that will extend the psychophilosophical study of human rationality to include social and emotional components as well, and may provide a significant breakthrough and to a better understanding of complex motion–cognition relationships.

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