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The Impact of Psychological Pressure and Psychological Traits on Performance – Experimental Evidence of Penalties in Handball

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Abstract

Our handball penalty field experiment analyses the influence of psychological traits and pressure on individual performance in sequential tournaments. We use a short ABBA-sequence with four throws for each subject and observe an average score rate of 60% in our sample of amateur league players. On game level, we find a weak and insignificant first-mover advantage that becomes stronger and significant if we control for psychological traits and pressure. On shot level, we also find no significant first-mover advantage on average. However, confident individuals have a higher scoring rate in the role of player A and less confident individuals in the role of player B. Moreover, ceteris paribus, player A scores more goals than player B under tournament incentives. Whereas self-esteem increases the probability to throw a goal in our experiment, risk-taking reduces it.

1. Introduction

In work life, individuals find themselves in a dynamic competitive environment that regularly puts them under psychological pressure when they perform their tasks. Competition arises e.g. by achieving career goals (like a promotion), a certain income level, or social standing (Apesteguia and Palacios-Huerta, 2010, Berger and Pope, 2011). The competitors see how the rival is performing a task, they compare themselves and react sequentially to each other's performance. This sequential competition can cause psychological pressure (Kocher et. al, 2012). For the optimal design of the workplace and the incentive schemes, it is essential to know how this stress affects individual performance (Dohmen, 2008).

Research results on individual performance in sequential competitions are contradictory. While some studies highlight a first-mover advantage (Apesteguia and Palacios-Huerta, 2010), others show that second-movers perform better (Feri et al., 2013). Finally, some authors neither find

a first nor a second-mover advantage (Kocher et al., 2012). Bühren and Steinberg (2019) explain these contrary results with individuals' heterogeneity, which results from psychological traits. These characteristics determine whether individuals thrive or choke under pressure and whether individual performance is better as a first- or as a second-mover. In their tennis field experiment, they find a moderating effect of self-esteem on the performance as a first- or second-mover: Subjects with a high level of self-esteem faced a second-mover advantage, whereas subjects with a low level of self-esteem performed better as a first-mover.

Against this background, our study aims to analyze the influence of psychological pressure and subjects' psychological characteristics on individual performance. In particular, we examine the impact on the relationship between player position and performance. Following Bühren and Steinberg (2019) as well as Bühren and Kadriu (2020), we conducted a field experiment with non-professional handball players who competed in a sequential competition (ABBA-sequence) with the task to hit penalties (seven meters away from the goal, in which a goalie tries to save the throw). The subjects were remunerated according to three different incentive schemes: individual, competition, and team payment, which are supposed to generate different levels of stress.

Our results show that there is no advantage for the first- or second-mover in the ABBA-sequence on shot level and, on average, no significant first-mover advantage on game level. However, the analysis of the individual performance of players A and B reveals that they react heterogeneously to performance under pressure. While the scoring probability of self-confident individuals is better in the role of player A, less self-confident individuals perform better in the role of player B. Compared to individual payment, the scoring probability of player A is higher under tournament payment. Furthermore, player A scores more goals than player B with tournament incentives. Controlling for psychological traits and pressure, player A wins the game significantly more often than player B.

Our paper is organized as follows: Section 2 gives an overview of the related literature. Section 3 describes the questionnaire and experimental design. Section 4 presents the results of descriptive statistics and regression analyses. Finally, we conclude and discuss our results.

2. Related literature

In the following section, the relevant theoretical models and empirical studies will be presented.

2.1. Performance under psychological pressure

Several empirical and experimental studies in behavioral economics and psychology find heterogeneous reactions of individuals to psychological pressure. While some individuals thrive in stressful situations (González-Díaz et al., 2012), others choke under pressure (Baumeister, 1984). As a theoretical explanation, two models are predominant: the "distraction model" and the "self-focus model". Proponents of the distraction model (e.g., Eysenck and Calvo, 1992) assume that, as a result of increased anxiety, irrelevant thoughts distract individuals' attention from the actual task, resulting in decreased performance. According to the self-focus model, individuals overthink the execution of their movements. This inhibits the automatic execution of their abilities, also resulting in performance decrements (Baumeister, 1984).

Various stress factors can have both positive and negative effects on performance in this context. In the following, we consider studies that focus on the influence of competition and performance-based payment as stress factors in more detail.

2.2. First- vs. second-mover advantage

Competition arises when people know that their performance is compared with the performance of others (explicit competition) or when they compare themselves with others (implicit competition) (Baumeister and Showers, 1986). Recent research in behavioral economics focuses on the impact of player position (first- vs. second-mover) on performance in sequential tournaments.

Apesteguia and Palacios-Huerta (2010) observe that 60.5% of 129 professional soccer teams between 1976 and 2003 who started a penalty shoot-out won the match. They explain this first-mover advantage by psychological pressure that the first team puts on the second when scoring a goal. However, when Kocher et al. (2012) extended their data set to 540 penalty shoot-outs from the same observation period, they found no significant advantage for first-movers. As a response, Palacios-Huerta (2014) enlarged his original data set to 1,001 shoot-outs until 2012 finding again a significant first-mover advantage. The strength of this advantage varies between nationalities. The author argues that this is caused by heterogeneity due to country-specific playing styles as well as different player characteristics.

Moreover, Palacios-Huerta (2014) compares three different sequences: ABAB (soccer sequence), ABBA (tennis sequence), and ABBABAAB (the Prouhet-Thue-Morse sequence introduced by Prouhet, 1851). In the latter two sequences, player A and player B are alternately first or second-movers. The author finds that the first-mover advantage is most obvious in the ABAB sequence (with a winning probability of 61% for the first team), followed by an insignificant advantage for the first-mover in the tennis sequence (54%). He identifies the Prouhet sequence as the fairest with no first- or second-mover advantage.

Kolev et al. (2015) compare penalty shoot-outs in the National Hockey League (NHL) before and after a rule change. Before 2006/2007, the home team had to perform as the second-mover. In this observation period, the data set does not indicate any significant differences between the performance of the home and away team. After 2006/2007, the home team was allowed to choose to start or not, and 76% favored to start the shoot-out. Surprisingly, the home teams' winning probability decreased after the rule change. Kolev et al. (2015) interpret this natural experiment as evidence in favor of a second-mover advantage. As explanations for their result, they state on the one hand the home team's overconfidence and on the other hand the decreased pressure on the second-mover when the first-mover fails to score. They calculate a scoring rate of 32.7%, which is significantly lower compared to the penalty shootout in Apesteguia and Palacios-Huerta's (2010) natural experiment (73.1%).

Depken et al. (2012) add that the goalkeeper is also under pressure, which is why Kolev et al. (2015) suggest that instead of a second-mover advantage of the shooter, there may be a first-mover advantage of the goalkeeper. This argument may explain the contradictory results of Kolev et al. (2015) and Apesteguia and Palacios-Huerta (2010). The latter assume that in soccer the shooter has a much higher advantage than the goalkeeper, whereas in ice hockey the reverse is true.

Studies that only look at individual performance do not have the identification problem of distinguishing between the shooter's and the goalie's responsibility in scoring or preventing a goal. Feri et al. (2013), e.g., conducted a field experiment with 57 amateur basketball players. For regular free-throws in an AAAAABBBBB-sequence, the authors do not find a first- or second-mover advantage. For tie-breaks in the ABAB-sequence, they observe a second-mover advantage. Bühren and Kadriu (2020) observe in a similar field experiment a second-mover advantage in a short ABBA-sequence with only four moves per player and no first- or second-mover advantage in a longer ABBA-sequence with ten moves each.

Berger and Pope (2011) provide an argument for a second-mover advantage by analyzing more than 60.000 basketball games of the National Basketball Association (NBA) and the National Collegiate Athletic Association (NCAA). The teams who were just behind at half-time won the game more often than expected possibly due to their increased motivation. These teams scored more frequently in the second half compared to the first half – especially just after the half-time break. However, Pope and Schweitzer (2011) argue that a small difference in points can put the leading player under pressure because of loss aversion.

In their tennis field experiment, Bühren and Steinberg (2019) used the tennis-sequence (ABBA) for a service task without an opponent on the other side of the net. On shot level, they discovered a significant second-mover advantage. Though, this advantage disappeared on game level, when player A is regarded as the first-mover of the whole match. According to Bühren and Steinberg (2019), the reason for the contradictory results on the effect of the order of play in the previous literature is the unconsidered heterogeneity in the psychological characteristics of individuals. Bühren and Steinberg (2019) assess psychological traits via a questionnaire. Moreover, they vary the degree of psychological pressure with different incentive schemes. In the next subsection, we review the literature on the effect of different incentive schemes on performance.

2.3. Impact of incentives on performance under pressure

Performance-based payment is used as a monetary incentive to motivate individuals to exert more effort compared to a fixed payment, and consequently to increase their performance (Rosen, 1988). In contrast, social psychologists note that performance-based payment generates psychological pressure: Striving for particularly good performance can paradoxically lead to performance decrements (Baumeister and Showers, 1986). Our experiment uses individual, tournament, and team payment schemes which can create a different stress level. Accordingly, the different payment schemes can have a different influence on a possible first- or second-mover advantage. The next two subsections compare previous results of the tournament and team payment compared to individual payment.

2.3.1. Tournament incentive scheme

Hannan et al. (2008) find in a laboratory experiment that the average performance of subjects was generally better with tournament (competition) compared to individual payment. Van Dijk

et al. (2001) observe that the mean and the variance of their subjects' effort is higher in competition than in individual payment. The authors argue that competition induces higher extrinsic motivation.

Hickmann and Metz (2015) analyze if the size of the prize money influences the scoring probability of putts on the last hole at the Professional Golfers' Association (PGA) Tour. Hitting or missing the last hole is decisive for the ranking in the tournament and accordingly for the individual's share of the prize money. They find that with increasing prize money the probability of successful puts on the last hole decreases, which they explain with psychological pressure.

2.3.2. Team incentive scheme

Erey et al. (1993) identify the problem of free-riding by observing the behavior of orange pickers under different incentive schemes. Workers who received a group wage based on the number of oranges in a group's shared container reduced their efforts after a while. Similarly, the results of London and Oldham (1977) indicate that the performance of subjects in a perceptual motor task is better under individual payment rather than team payment. Van Dijk et al. (2001) also identify free-rider in group work. However, their underperformance is compensated by more effort of other group members in the team payment scheme compared to individual payoffs. Hill and Shaw (2013) point out that peer pressure in teams causes psychological pressure. In contrast, in an agent-based simulation by Ladley et al. (2015), the agents perform better under team compared to individual payment.

2.4. Impact of individual and psychological traits on performance

Cohen-Zada et al. (2017) find that male professional tennis players fail more often than women under competitive pressure. They explain their finding referring to the biological literature on the stress hormone cortisol: A high level of cortisol can lead to inhibition of mental abilities and poor performance (Doan et al., 2007), and men's cortisol level increases faster than women's (Kirschbaum et al., 1992). However, Klaassen and Magnus (2014) observe for single tennis matches in Wimbledon that women play worse at important points, whereas the best men nearly play at their usual level.

Individuals with a high locus of control assume that outcomes depend strongly on their abilities and performance. With a low control conviction, they assume that results are driven by external factors (Rotter, 1966). Spector (1982) and Chen and Silverthorne (2008) find a positive correlation between locus of control and individual work performance. In Bühren and Steinberg's

(2019) tennis field experiment, a higher control conviction leads to a higher hit rate, whereas Bühren and Kadriu (2020) find the opposite effect in a basketball field experiment.

Besides locus of control, both field experiments analyze self-esteem and self-efficacy. These three traits show the strongest effect on work performance in the theory of self-assessment (Judge and Bono, 2001). The authors also studied the influence of self-confidence, risk preferences, and competitive preferences on performance and the relationship between player position and performance. We will follow their approach in our study.

The meta-analysis by Judge and Bono (2001) finds for work performance the highest positive correlation with self-esteem. Self-esteem is defined by how much value individuals subjectively ascribes to themselves (Baumeister et al., 2003). Yet, Wallace and Baumeister (2002) find no effect of students' self-esteem on their performance in solving math problems. Baumeister et al. (2003) show that high self-esteem does not have to lead to good school performance, but rather that there is reverse causality: Good school performance results in high self-esteem. Concerning the first- vs. second-mover advantage, Bühren and Steinberg (2019) find in their sample that the performance of subjects with low self-esteem is better when they are first-movers. In contrast, those with high self-esteem perform better as a second-mover. Following Apesteguia and Palacios-Huerta (2010), Bühren and Steinberg (2019) argue that players with low self-esteem are under psychological pressure when they have to perform after their opponent. By contrast, individuals with high self-esteem may see this situation as an advantage. This means that whether a first- or second-mover advantage is present could be determined by the level of self-esteem in the sample.

Self-efficacy refers to the belief in one's abilities to cope with specific tasks or situations. It describes the extent to which one's competencies influence the achievement of one's own goals (Bandura, 1977, 1997). The meta-analyses of Stajkovic and Luthans (1998) as well as of Judge and Bono (2001) report a positive correlation between self-efficacy and work performance. Similarly, Lu et al. (2016) show that self-efficacy reinforces the positive relationship between task-related stress factors (e.g., time pressure or high responsibility) and work performance. In contrast, the meta-analysis of Sitzmann and Yeo (2013) finds only an insignificant positive correlation between these variables.

Compared to self-efficacy, self-confidence describes the general optimism of individuals in their abilities (Vealey, 1988). The meta-analysis by Woodman and Hardy (2003) reports a positive influence of self-confidence on performance – especially among men. The authors refer to

several field studies in sports showing that in various disciplines the performance of athletes with low self-confidence decreases in stressful situations (e.g., Burton, 1988 or Martin and Gill, 1991). Conversely, Gould et al. (1987) find a negative correlation between self-confidence and performance. Hill and Shaw (2013) conducted qualitative surveys with team athletes. The majority of respondents attributed their experiences of choking under pressure to low self-confidence. They state that they failed because they could not keep their focus on the actual task at the start of the game and because they lost the belief that they were doing something right.

Some sports economics studies examined under which circumstances high uncertainty lead to increased risk-taking behavior of teams and how this affects performance and outcomes (e.g., Grund et al., 2013, Lehman and Hahn, 2013). Yet, they do not find a direct correlation between risk-taking and individual performance or performance under pressure.

According to Helmrich et al. (1978), competitive preferences reflect the extent to which an individual enjoys interpersonal competition. Lam (2012) finds a positive relationship between competitive preferences and individual performance. The author argues that a person with a high level of competitive preferences feels comfortable in competitive situations, which has a positive effect on performance. Reversely, a person who experiences anxiety in competition may suffer from choking under pressure. In this context, Niederle and Vesterlund (2011) observe a gender difference: At least in math tasks, women tend to shy away from competition, whereas men more often select themselves into competitive situations.

3. Design of the study and dataset

This study consists of two parts: the questionnaire and the experiment. The underlying data were collected during the regular training of amateur handball teams of different leagues.

3.1. Questionnaire and experiment

Before the experiment, all subjects filled out a questionnaire based on Bühren and Steinberg (2019). In addition to personal information like age and gender, it assesses the psychological characteristics described in Section 2. At that time, the participants did not know yet under which incentive scheme they will be paid.

Two randomly chosen players in a session formed a pair and threw four penalty shots (seven-meter throws) each in the ABBA-sequence – We call this shootout a “game”. We assigned the roles of player A and player B randomly. We select the ABBA-sequence because the players perform alternately as first- and as second-movers on shot level (see Bühren and Steinberg,

2019). Thus, a within-subject (and a between-subject) comparison between first- and second-movers is possible on shot level. Moreover, an altering sequence resembles most of the real-life applications, since a person rarely acts permanently as a first-mover.

The increasing importance of the ABBA-sequence is illustrated for instance by the television duels of the 2016 US presidential election (Cohen-Zada et al., 2018). Moreover, the Union of European Associations (UEFA) tested this order of play in penalty shootouts at the Women's U-17 European Football Championship in 2017 when considering the general introduction of the ABBA-sequence (UEFA, 2017).

We paid our subjects according to three different incentive schemes, which are supposed to generate different levels of competition levels and, thus, stress:

1. *Individual payment*: For each goal, the player received €0.50 – regardless of his or her partner's performance. It represents the control group with a medium level of competition.
2. *Tournament payment:* The payment follows the "winner takes all" principle of Smither and Houston (1992). The participant who scored more often won €2 and the loser received nothing. The degree of competition and, thus, the psychological pressure is arguably highest in this treatment. In the case of a draw, a tie-break followed, in which the ABBA-sequence did not change until the game was decided.
3. *Team payment:* The player pair received €0.50 per goal. After the game, we divided the final winning amount equally between the two. The competitive pressure should be lowest in this treatment and, thus, the stress induced by competition should be lowest. Nevertheless, peer pressure may be present (Hill and Shaw, 2013).

Furthermore, under individual and team payment, there may be an implicit competition, in which the assigned subjects compare their performance with each other (Baumeister and Showers, 1986). Usually, non-professional handball players do not receive any remuneration for playing handball. For this reason, an effective incentive can be assumed through our payment schemes. We randomly assigned incentive schemes to sessions. We did not randomize the incentive schemes within sessions because subjects saw the games of other subjects in the same session and we were afraid of experimenter demand effects.

3.2. Variables

In the following, we describe the relevant variables obtained from the questionnaire and the experiment.

3.2.1. Individual variables of the questionnaire

Gender is represented by a dummy variable which takes the value 1 if the subject is female and 0 if the subject is male. Their *age* at the time of the experiment is measured in years. *League* is used to record the typical performance level of the players in a session. The lowest league in our sample has the value 1 (when the handball team played in the German "Bezirksklasse C"). The highest value is 6 ("Oberliga"). The goalkeeper is a member of the same team and has the same performance level.

In handball, any player of the team can be selected to take a penalty (seven-meter throw) during a league match in the season. The *seven-meter* variable takes into account that there may be different levels of performance between players within a team concerning hitting penalties. Players who regularly take the penalties during the season might perform better than their teammates because the coaches and/or the teammates probably have chosen them according to their skills. Also, they have more practical experience with the seven-meter throw and are regularly exposed to situations of psychological pressure similar to the setting of our experiment. We measure this variable with three categories. If the player regularly takes the penalties in the season, the variable *seven-meter* takes the value 2, the value 1 if the player takes the seven-meter throw sometimes, and 0 if the player never throws penalties.

The questionnaire by Bühren and Steinberg (2019) is the basis for our measurement of the players' psychological traits. *Locus of control* is assessed with items from the Socio-Economic Panel (SOEP) survey wave from 2005 and 2010, which are based on Rotter (1966) and Krampen (1981). The respondents evaluated ten statements on a Likert scale from 1 (completely disagree) to 7 (completely agree). The average locus of control in our sample reflects an internal locus of control (see Table 2). *Self-esteem* was also measured on a 7-point Likert scale. We followed Robins et al. (2001) and measured global self-esteem using a single item. The measurement of *self-efficacy* is based on the generalized self-efficacy scale of Schwarzer and Jerusalem (1995 and 1999) with ten items on a scale from 1 to 4. The average score shows a relatively high self-efficacy in our sample, i.e., our subjects believe that they can handle difficult situations and achieve their goals with their competencies. We assess *self-confidence* with six questions addressing one's abilities in sports on a 7-point Likert scale.

We also took the questions on *risk preferences* from the German SOEP. Those have been validated e.g. in Dohmen et al. (2011). Using a 7-point Likert scale, the subjects assessed their risk preference in six different areas of life, such as driving, financial investments, sports, career, health, and trust in strangers. Our players also assessed their global competitive preferences (*competitiveness*) in different areas of life. We extended the European Commission's survey (the Flash Eurobarometer Survey on Entrepreneurship 2009, no. 283), in which competitiveness is measured with a single item ("I like situations in which I compete with others"). On a 7-point Likert scale, respondents rated their competitive preferences in general, work-life, personal life, as well as leisure and sport. To measure competitiveness in sports more specifically, we added 23 items on competitive preferences in sports using the same scale.

3.2.2. Throw related variables of the experiment

The three dummy variables *individual, tournament, and team payment* indicate with which incentive scheme the player pair was paid. *Throw number* refers to the number of the throw of each subject in the game. Thus, possible learning effects can be controlled for.

The dummy variable *throw success* indicates whether the player scored (1) the corresponding penalty throw or not (0). The variables *player's previous shot (scored)* and *opponent's previous shot (scored)* take the value 1 if the player (and the opponent, respectively) threw a goal directly before the current throw and 0 otherwise. Note that in the ABBA-sequence the means of these two variables are smaller than the mean of *throw success* (see Table 2) because for half of the moves there is no previous shot of the player or the opponent immediately before the current shot (and the variables take the value 0).

Score difference indicates the number of goals scored so far by the focal player minus the goals scored by the opponent. If the score difference is positive, the focal player is in the lead and if it is negative, he or she is behind. In the case of a draw, the variable takes the value 0. *Worthy* evaluates if the corresponding throw is still decisive for the outcome of the game: It takes the value 0 if the focal player’s final score will be higher or lower than his or her opponent’s score no matter if he or she scores the penalty, and 1 otherwise.

The dummy variable *first-mover* identifies whether the player takes the throw as a first-mover (1) or as a second-mover (0) on shot level (see Bühren and Steinberg, 2019). To examine the first- vs. second-mover advantage on game level, the dummy variable *player A* defines whether the test person is player A (1) or player B (0) in the ABBA-sequence.

4. Results

4.1. Descriptive analysis

We observe 578 throws of 140 handball players, who play in 15 different teams. As can be seen from Table 1, the number of throws of men and women is balanced both within and between the three incentive schemes. Only in the tournament group, there are slightly more throws of women than of men. However, this difference is not significant according to a one-sided binomial test (p=0.361).

Table 1
Frequencies and percentages for incentive schemes by gender.

		Incentive schemes			
		Individual	Tournament	Team	Total
Male	*Frequency (n)*	96	96	96	288
	% of total	*(16.50%)*	*(16.50%)*	*(16.50%)*	*(49.50%)*
Female	*Frequency*	96	102	96	294
	% of total	*(16.50%)*	*(17.50%)*	*(16.50%)*	*(50.50%)*
Total	*Frequency*	192	198	192	582
	% of total	*(33.00%)*	*(34.00%)*	*(33.00%)*	*(100%)*

Note: N = 578. Neither the values in the columns nor in the rows differ significantly.

Table 2 summarizes the mean, standard deviation, minima, and maxima for all variables. Table 3 reports the correlation matrix. There is no evidence of multicollinearity as none of the correlation coefficients exceeds 0.7 and the highest variance inflation factor (VIF) is 2.48. The significant correlation of the incentive schemes with age and the correlation of tournament and team incentives with league show that the randomization of the schemes across sessions was not perfect in our field experiment. In contrast, the first-mover and player A variables do not correlate to individual variables.

Table 2:
Summary statistics of the sample.

Variables		Mean	sd	Min	Max
1	Throw success	0.60	0.49	0	1
Individual-level variables					
2	Gender	0.51	0.50	0	1
3	Age	24.83	7.73	16	68
4	League	3.60	1.40	1	6
5	Seven-meter	0.54	0.76	0	2
6	Locus of control	4.96	0.53	2.70	6.00
7	Self-esteem	4.66	1.23	1.00	7.00
8	Self-efficacy	2.97	0.38	1.80	3.90
9	Self-confidence	4.37	0.10	1.67	6.67
10	Risk	4.00	1.41	2.00	6.17
11	Competitiveness	4.42	0.74	2.57	6.30
Experiment-level variables					
12	Individual incentive	0.34	0.47	0	1
13	Tournament incentive	0.31	0.47	0	1
14	Team incentive	0.34	0.47	0	1
15	Throw number	2.62	1.32	1	9
16	Player's previous shot (scored)	0.23	0.42	0	1
17	Opponent's previous shot (scored)	0.31	0.46	0	1
18	Score difference	-0.30	1.05	-4	3
19	Worthy	0.88	0.01	0	1
20	First-mover	0.50	0.50	0	1
21	Player A	0.05	0.50	0	1

Note: N = 140.

Table 3:
Correlation matrix.

	Variables	1	2	3	4	5	6	7	8	9	10
1	Throw success	1									
2	Gender	-0.19*	1								
3	Age	0.06	-0.19*	1							
4	League	0.01	0.36**	-0.33**	1						
5	Seven-meter	0.13	-0.13**	0.22*	0.01	1					
6	Locus of control	0.04	-0.17*	0.17	-0.11*	-0.07	1				
7	Self-esteem	0.24*	-0.23*	0.13	-0.10	0.11	0.34**	1			
8	Self-efficacy	0.01	-0.27*	0.24*	-0.21*	0.03	0.14	0.44**	1		
9	Self-confidence	0.06	-0.28**	0.08	0.05	0.23*	0.09	0.21*	0.25*	1	
10	Risk	-0.12	-0.13	-0.04	-0.15	0.09	0.15**	0.11	0.14	-0.01	1
11	Competitiveness	0.09	-0.28**	0.04	0.04	0.11	0.09	0.14	0.24*	0.54**	-0.02
12	Individual incentive	-0.01	-0.02	0.16*	-0.12	0.04	0.14	0.10	0.06	-0.10	-0.03
13	Tournament incentive	-0.10	0.04	-0.16*	-0.44**	0.06	-0,01	-0.18*	0.10	-0.03	0.11
14	Team incentive	-0.04	-0.02	-0.31**	0.56**	-0.10	-0.13	0.07	-0.15	0.12	-0.08
15	Player's previous shot (scored)	-0.05	-0.13	0.06	0.01	0.16	0.07	0.07	0.06	-0.05	0.05
16	Opponent's previous shot (scored)	-0.15	-0.10	-0.01	-0.01	0.01	-0.03	-0.04	0.01	-0.15	-0.05
17	Score difference	0.17*	0.01	0.08	-0.02	0.03	0.01	0.14	-0.03	0.17*	-0.04
18	Worthy	0.07	-0.10*	-0.03	0.03	-0.05	0.12	0.01	0.08	-0.11	-0.01
19	First-mover	-0.13	0.07	-0.05	-0.09	-0.10	0.07	0.01	0.13	-0.13	0.15
20	Player A	0.01	0.00	0.00	0.00	-0.09	-0.02	0.12	-0.03	0.16	-0.13

Table 3 (*continued*).

	Variables	12	13	14	15	16	17	18	19	20
12	Individual incentive	1								
13	Tournament incentive	-0.50**	1							
14	Team incentive	-0.52**	-0.49**	1						
15	Player's previous shot (scored)	-0.03	-0.03	0.01	1					
16	Opponent's previous shot (scored)	-0.01	-0.01	0.14	0.07*	1				
17	Score difference	-0.01	-0.01	-0.04	0.41**	-0.55**	1			
18	Worthy	-0.09	-0.01	0.12	0.08	0.05	0.04	1		
19	First-mover	-0.05	-0.05	-0.05	-0.02	-0.06	-0.02	0.06	1	
20	Player A	0.00	0.00	0.00	-0.44**	-0.11	0.10	-0.19*	0.14	1

Note: N = 140; significance levels: ** $p < 0.01$. * $p < 0.05$.

4.2. Multivariate analysis

To estimate the impact of player position on performance as well as the influence of heterogeneity of psychological traits, we employ several probit models with the dependent variable *throw success*. Since our subjects threw more than one penalty in the experiment, our data set involves panel data. We acknowledge this by measuring robust standard errors clustered at the player level.

Model 1 (in Table 4) covers the individual variable including psychological traits, the incentive schemes, and the throw-related variables as independent variables. The model shows that men score more often than women: Their scoring probability is 10 percentage points higher, but only with a p-value of p=0.051. In line with Judge and Bono (2001), self-esteem has a direct positive effect on performance (p=0.001): Ceteris paribus, subjects with the highest self-esteem in our sample score with a 36 percentage points higher probability than subjects with the lowest self-esteem. In contrast, risk-averse individuals perform better in our experiment than risk-tolerant individuals (p=0.030). The throw success under tournament and team incentives does not differ significantly from the throw success under individual incentives.

In Model 2, we add the first-mover dummy, and we do not find a first- (or second-) mover advantage on shot level. All further models build on Model 2. Models 3 to 8 include the interactions of player position (first-mover) with psychological traits and Model 9 the interactions with incentive schemes (Table 5). Following Ai and Norton (2003), we calculated the interaction effects using the *inteff* command (in STATA). Models 3 to 9 (Table 5) show neither support for a moderation effect of psychological traits nor of incentive schemes on the relationship between player position and throw success. Model 10 uses a full model and corroborates the results of Models 3 to 9.

Table 4:
The effect of psychological traits, incentive systems, and player position (first-mover) on performance.

	Model 1		**Model 2**	
	Probit	margins	Probit	margins
Individual-level variables				
Gender	-0.27* (0.14)	-0.10* (0.05)	-0.28* (0.14)	-0.10* (0.05)
Age	0.00 (0.01)	0.00 (0.00)	0.00 (0.01)	0.00 (0.00)
League	0.01 (0.06)	0.00 (0.02)	0.01 (0.06)	0.00 (0.02)
Seven-meter = 1	0.10 (0.13)	0.04 (0.05)	0.09 (0.13)	0.03 (0.05)
Seven-meter = 2	0.19 (0.18)	0.07 (0.06)	0.20 (0.18)	0.07 (0.06)
Locus of control	-0.03 (0.12)	-0.01 (0.04)	-0.03 (0.12)	-0.01 (0.04)
Self-esteem	0.16**(0.05)	0.06**(0.02)	0.16**(0.05)	0.06**(0.02)
Self-efficacy	-0.15 (0.17)	-0.05 (0.06)	-0.15 (0.17)	-0.05 (0.06)
Self-confidence	-0.06 (0.05)	-0.02 (0.02)	-0.06 (0.05)	-0.02 (0.02)
Risk	-0.13* (0.06)	-0.05*(0.02)	-0.13* (0.06)	-0.05* (0.02)
Competitiveness	0.05 (0.08)	0.02 (0.03)	0.05 (0.08)	0.02 (0.03)
Experimental-level variables				
Tournament incentive	0.24 (0.14)	0.09 (0.05)	0.24 (0.14)	0.09 (0.05)
Team incentive	0.27 (0.17)	0.10 (0.06)	0.26 (0.17)	0.09 (0.06)
Throw number	-0.05 (0.05)	-0.02 (0.02)	-0.05 (0.05)	-0.02 (0.02)
Player's previous shot (scored)	0.08 (0.15)	0.02 (0.06)	-0.02 (0.16)	-0.01 (0.06)
Opponent's previous shot (scored)	0.03 (0.13)	0.02 (0.05)	0.16 (0.17)	0.06 (0.06)
Score difference	0.03 (0.05)	0.01 (0.02)	0.04 (0.05)	0.02 (0.02)
Worthy	-0.15 (0.19)	-0.06 (0.07)	-0.17 (0.19)	-0.06 (0.07)
First-mover			0.10 (0.16)	0.07 (0.06)
Constant	0.87 (0.80)		0.72 (0.82)	
N (players)	140		140	
N (observations)	578		578	
Wald chi2	38.36		38.89	
Log-pseudolikelihood	-375.50		-371.74	
Prob > chi2	0.0035		0.0046	
Pseudo R2	0.0380		0.0400	

Notes: Dependent variable: Throw success. Standard errors are in parentheses and average marginal effects in margins column. Standard errors are clustered at the player level. Significance levels: ** $p < 0.01$, * $p < 0.05$. Reference categories: Seven-meter = 0, Individual incentive.

In further analyses, we acknowledge that subjects may perceive player A as the first mover during the whole game and may not recognize the switch between the first- and second-mover on shot level of ABBA-sequences. We examine whether there are significant differences in the

winning probability (on game level) and in the throwing success (on shot level) of player A and player B.

On game level, considering the winning percentages in all three incentive schemes,[1] we do not find a significant first-mover advantage according to a two-sided binomial test (player A wins the game in 54.29%, p=0.550). Hence, in line with prior research (Palacios-Huerta, 2014, Cohen-Zada et al., 2018, Bühren and Steinberg, 2019, and the long sequence in Bühren and Kadriu, 2020), the ABBA-sequence produces, on average, fair outcomes in our field experiment. However, the first-mover advantage is strong and significant (25 percentage points, $p<0.01$) if we control for psychological traits and psychological pressure: incentive schemes, the closeness of the game indicated by the absolute value of the score difference[2], and the pressure of opponent's goals directly before own first shots in contrast to the positive momentum of hitting first attempts before second attempts in the ABBA-sequence[3] (see Table 6, Model 11). On game level, we observe interaction effects of locus of control and *player A* (Model 12) as well as self-efficacy and *player A* (Model 14) on the probability to win the game: The first-mover advantage is especially pronounced if player A has an internal locus of control and high levels of self-efficacy.

For the shot level analysis of player A and player B, the first-mover variable of Models 2 to 10 is replaced by the variable *player A* (see Table 7). Again, *throw success* is the dependent variable. In Model 20, the difference of throw success between player A and player B is insignificant, which indicates fairness of the ABBA-sequence (on average). The only interaction effect of player position (*player A*) and psychological traits that is significant in the full model (Model 28) is the interaction with self-confidence (in Model 24, the marginal effect of this interaction is 0.06 with a p-value of 0.054). Figure 1 illustrates that the scoring probability of self-confident individuals is higher when they perform in the role of player A (solid line). In contrast, individuals with low self-confidence perform better in the role of player B (dashed line).

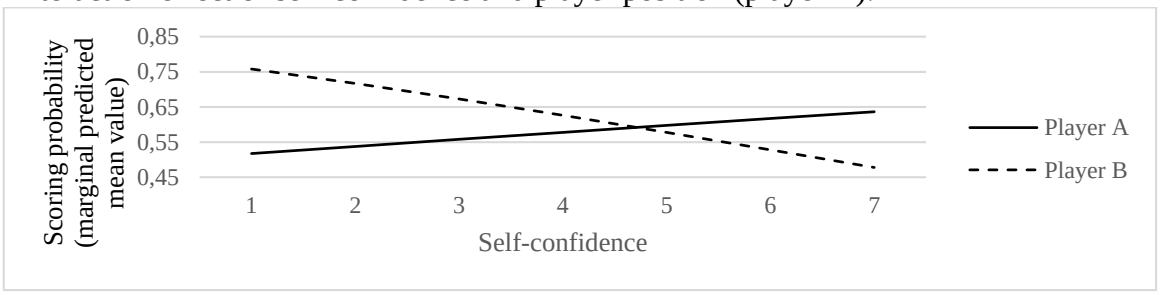
[1] In each incentive scheme, the player who scores the most goals is considered as the winner. This means that even though the participants receive the same amount of money in the team payment, a winner is also defined in this incentive scheme.

[2] Whereas in shot level analyses of throw success, we use *score difference* as described in Section 3.2.2., we take the absolute value of this variable in the analyses of winning probabilities on game level to circumvent problems with endogeneity.

[3] Note that player B has two second attempts in a four moves ABBA-sequence and player A only one.

According to Apesteguia and Palacios-Huerta (2010), it could motivate confident individuals to start the game (to be player A) trying to put pressure on player B. By contrast, very confident individuals in the role of player B seem to suffer from overconfidence (see also Kolev et al., 2015). Since the average scoring rate in our experiment is 60% (Table 2), our players see goals after most of the throws. While seeing the goal of an opponent might put pressure on the next player's throw, it could also motivate him or her. Furthermore, with every goal scored, players can update their belief that the goalkeeper is not invincible. In line with the explanation by Hill and Shaws (2013), players with lower self-confidence seem to feel greater psychological pressure when starting the game and, therefore, their attention could be distracted. However, they seem to feel less pressure in the role of player B. One explanation may be that player B is not directly confronted with the task and can observe the first move of player A before performing the first time.

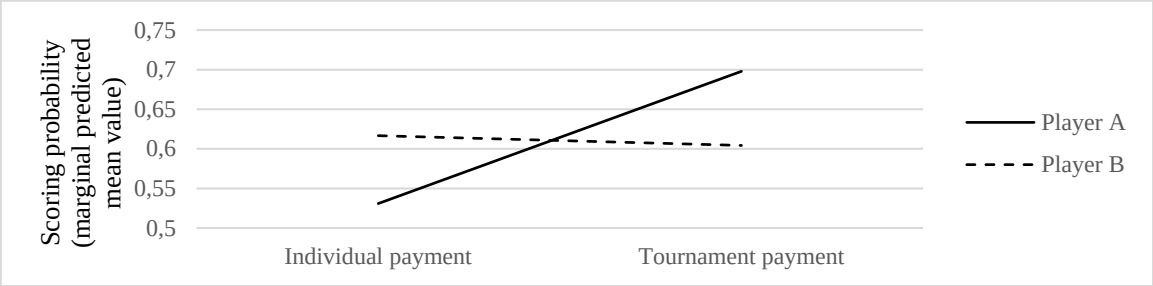
Figure 1
Interaction effect of self-confidence and player position (player A).



Note: N = 578. The interaction effect was calculated based on Model 24 in Table 7 and the predicted margins; the marginsplot follows the approach of Williams (2012) using the command *margins, at (Self-confidence=(1 2 3 4 5 6 7) PlayerA=(0 1)).*

Model 27 includes the interaction term of the incentive systems with the player A variable. Team payment and player position have no significant interaction effect on performance (p=0.134). The interaction effect of the tournament treatment with the player position is stronger and significant (0.20 with a p-value of 0.043). Figure 2 shows that the scoring probability of player A is higher under tournament compared to individual incentives. With tournament payment, player A's scoring probability is almost ten percentage points higher than the one of player B. Consequently, there is a first-mover advantage in the tournament incentive scheme on game level. The argument of Apesteguia and Palacios-Huerta (2010) that player A wants to put pressure on the following player seems to be especially relevant in very competitive environments. For player B, however, tournament incentives have a negligible effect on performance – it neither seems to be a big stress factor nor a motivator.

Figure 2
Interaction effect of tournament incentive and player position (player A).



Note: N = 578. Reference category: Individual incentive. The interaction effect was calculated based on Model 27 in Table 7 and the predicted margins; the marginsplot follows the approach of Williams (2012) using the command *margins, at (Tournament-incentive=(0 1) PlayerA=(0 1))*.

5. Conclusion and discussion

We conducted a field experiment to investigate the extent to which heterogeneity due to psychological traits and psychological pressure (generated by different incentive schemes) affects the performance of non-professional handball players in a sequential tournament. Additionally, we examined whether the heterogeneity can explain previous contradictory results on the first- vs. second-mover advantage. In contrast to Bühren and Steinberg (2019), we find no second-mover advantage on shot level of the ABBA-sequence. Moreover, psychological traits and incentive schemes do not affect the relationship between performance and player position on shot level in our sample. Yet, we find a direct positive effect of self-esteem and a negative effect of risk-taking on shot success.

In an ABBA-sequence, player A and player B are taking turns in being first- or second-mover. However, subjects in the role of player B might not perceive themselves as first-movers on shot level of ABBA-sequences. Thus, we reexamined our data considering player A as the first-mover during the whole game (and player B as the second-mover) – on game and also on shot level. On game level, we find no significant first-mover advantage on average. This finding confirms the fairness of the ABBA-sequence also found for soccer penalties (Palacios-Huerta, 2014) and tennis tie-breaks (Cohen-Zada et al., 2018, and Bühren and Steinberg, 2019). Bühren and Kadriu (2020) only observe this fairness for long ABBA-sequences with ten basketball free throws for each player and advantage of player B with four moves with an average shot success of 20% in their sample. Controlling for psychological traits of our subjects and psychological pressure in our four moves game with an average throw success of 60%, we find a significant

first-mover advantage, especially pronounced if player A has an internal locus of control and high levels of self-efficacy.

On shot level, we also find that heterogeneity influences the individual performance of player A and player B. The scoring probability of self-confident individuals is higher in the role of player A. Conversely, less self-confident individuals have a higher scoring probability in the role of player B. Consequently, confident individuals should be encouraged to start sequential tournaments. Concerning the incentive schemes, the scoring probability of player A is higher under tournament payment than under individual payment. Furthermore, player A scores with a higher probability than player B under tournament incentives – indicating a first-mover advantage in a competitive environment. The incentive schemes have only little impact on the performance of player B.

Our results indicate that first- or second-mover advantages should be analyzed in combination with the degree of psychological pressure and considering psychological traits like self-confidence. It should be noted that our experiment took place within a team and in familiar surroundings (during practice sessions). The psychological pressure could be lower compared to competitive situations like in work life or in natural experiments, where the consequences of the performance can be far-reaching (e.g., concerning the further career) (González-Díaz et al., 2012). Moreover, the payment in this field experiment is much lower than in natural experiments with professionals. Its effect as a stress factor or as an incentive could increase with higher payoffs (Hickmann and Metz, 2015).

Handball is well suited for similar field experiments because all incentive schemes analyzed in this paper are relevant and familiar: Handball players perform in a team competing against other teams, their individual performance is important for their playing time in the current and next matches as well as for their sense of achievement.

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Table 5
The interaction effects of player position (first-mover) and psychological traits, resp. incentives, on individual performance.

	Model 3	**Model 4**	**Model 5**	**Model 6**
	margins	margins	margins	margins
Individual-level variables				
Gender	-0.10* (0.05)	-0.10* (0.05)	-0.10* (0.05)	-0.10* (0.05)
Age	0.00 (0.00)	0.00 (0.05)	0.00 (0.00)	0.00 (0.00)
League	0.00 (0.02)	0.00 (0.02)	0.00 (0.02)	0.00 (0.02)
Seven-meter = 1	0.03 (0.05)	0.04 (0.05)	0.04 (0.05)	0.03 (0.05)
Seven-meter = 2	0.07 (0.06)	0.07 (0.06)	0.07 (0.06)	0.07 (0.06)
Locus of control	0.04 (0.04)	-0.01 (0.04)	-0.01 (0.04)	-0.01 (0.04)
Self-esteem	0.06**(0.02)	0.07** (0.03)	0.06** (0.02)	0.06**(0.02)
Self-efficacy	-0.05 (0.07)	-0.05 (0.07)	-0.01 (0.09)	-0.06 (0.07)
Self-confidence	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)
Risk	-0.05* (0.02)	-0.05*(0.02)	-0.05* (0.02)	-0.05* (0.02)
Competitiveness	0.02 (0.03)	0.02 (0.03)	0.03 (0.03)	0.02 (0.03)
Experimental-level variables				
Tournament incentive	0.09 (0.05)	0.09 (0.05)	0.09 (0.05)	0.09 (0.05)
Team incentive	0.10 (0.06)	0.09 (0.06)	0.10 (0.06)	0.10 (0.06)
Throw number	-0.02 (0.02)	-0.01 (0.02)	-0.02 (0.02)	-0.02 (0.02)
Player's previous shot (scored)	0.00 (0.06)	-0.01 (0.06)	-0.01 (0.06)	-0.01 (0.06)
Opponent's previous shot (scored)	0.06 (0.06)	0.06 (0.06)	0.06 (0.06)	0.06 (0.06)
Score difference	0.02 (0.02)	0.02 (0.02)	0.01 (0.02)	0.01 (0.02)
Worthy	-0.07 (0.07)	-0.06 (0.07)	-0.06 (0.07)	-0.06 (0.07)
First-mover (FM)	0.60 (0.37)	0.17 (0.15)	0.32 (0.32)	0.12 (0.16)
Locus of control * FM	-0.10 (0.07)			
Self-esteem * FM		-0.02 (0.03)		
Self-efficacy * FM			-0.08 (0.10)	
Self-confidence * FM				-0.01 (0.03)
Constant	0.04 (0.91)	0.59 (0.82)	0.39 (0.96)	0.64 (0.84)
N (players)	140	140	140	140
N (observations)	578	578	578	578
Wald chi2	43.23	40.14	42.78	38.85
Log-pseudolikelihood	-370.79	-371.52	-371.43	-371.67
Prob > chi2	0.0019	0.0048	0.0014	0.0070
Pseudo R2	0.0425	0.0406	0.0408	0.0402

Table 5 (continued).

	Model 7	**Model 8**	**Model 9**	**Model 10**
	margins	margins	margins	margins
Individual-level variables				
Gender	-0.10* (0.05)	-0.10* (0.05)	-0.10* (0.05)	-0.10* (0.05)
Age	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
League	0.00 (0.02)	0.00 (0.02)	0.00 (0.02)	0.00 (0.02)
Seven-meter = 1	0.03 (0.05)	0.03 (0.05)	0.03 (0.05)	0.03 (0.05)
Seven-meter = 2	0.07 (0.06)	0.07 (0.06)	0.07 (0.06)	0.07 (0.06)
Locus of control	-0.01 (0.04)	-0.01 (0.04)	-0.01 (0.04)	0.04 (0.06)
Self-esteem	0.06**(0.02)	0.06**(0.02)	0.06**(0.02)	0.06*(0.03)
Self-efficacy	-0.06 (0.07)	-0.06 (0.07)	-0.06 (0.07)	-0.04 (0.09)
Self-confidence	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)
Risk	-0.05 (0.03)	-0.05* (0.02)	-0.05* (0.02)	-0.05 (0.03)
Competitiveness	0.02 (0.03)	0.02 (0.04)	0.02 (0.03)	0.02 (0.03)
Experimental-level variables				
Tournament incentive	0.09 (0.05)	0.09 (0.05)	0.07 (0.07)	0.07 (0.07)
Team incentive	0.10 (0.06)	0.10 (0.06)	0.08 (0.08)	0.09 (0.08)
Throw number	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)
Player's previous shot (scored)	-0.01 (0.06)	-0.01 (0.06)	-0.01 (0.06)	-0.01 (0.06)
Opponent's previous shot (scored)	0.06 (0.06)	0.06 (0.06)	0.06 (0.06)	0.06 (0.06)
Score difference	0.01 (0.02)	0.01 (0.02)	0.02 (0.02)	0.02 (0.02)
Worthy	-0.06 (0.07)	-0.06 (0.07)	-0.06 (0.07)	-0.07 (0.07)
First-mover (FM)	0.05 (0.21)	0.09 (0.20)	0.05 (0.07)	0.61 (0.50)
Locus of control * FM				-0.09 (0.08)
Self-esteem * FM				0.00 (0.04)
Self-efficacy * FM				-0.04 (0.11)
Self-confidence * FM				-0.01 (0.03)
Risk * FM	0.01 (0.05)			0.01 (0.05)
Competitiveness * FM		0.00 (0.04)		0.01 (0.01)
Tournament incentive * FM			0.04 (0.10)	0.03 (0.10)
Team incentive * FM			0.03 (0.09)	0.01 (0.10)
Constant	0.75 (0.88)	0.69 (0.85)	0.75 (0.83)	0.03 (1.07)
N (players)	140	140	140	140
N (observations)	578	578	578	578
Wald chi2	39.20	38.94	40.33	47.98
Log-pseudolikelihood	-371.73	-371.74	-371.63	-370.48
Prob > chi2	0.0063	0.0068	0.0063	0.0077
Pseudo R2	0.0400	0.0400	0.0403	0.0433

Notes: Dependent variable: Throw success. Standard errors are in parentheses and average marginal effects in margins column. Standard errors are clustered at the player level. Significance levels: ** $p < 0.01$, * $p < 0.05$. Reference categories: Seven-meter = 0, Individual incentive. In Models 9 and 10, the command *margins, dydx (*)* was used to calculate the marginal effects of the interaction terms (Williams, 2012) because the command *inteff* can only compute one interaction effect in a model.

Table 6
The interaction effects on game level: player position (player A) and psychological traits, resp. incentives, on individual performance.

	Model 11	**Model 12**	**Model 13**
	margins	margins	margins
Individual-level variables			
Gender	0.09 (0.09)	0.11 (0.09)	0.10 (0.09)
Age	0.00 (0.01)	0.01 (0.01)	0.00 (0.00)
League	-0.03 (0.04)	-0.04 (0.04)	-0.03 (0.04)
Seven-meter = 1	-0.12 (0.10)	-0.10 (0.03)	-0.03 (0.04)
Seven-meter = 2	0.05 (0.11)	0.06 (0.10)	0.06 (0.11)
Locus of control	0.01 (0.08)	0.15 (0.11)	0.01 (0.08)
Self-esteem	0.01 (0.03)	0.01 (0.03)	0.02 (0.04)
Self-efficacy	0.07 (0.11)	0.05 (0.11)	0.07 (0.11)
Self-confidence	-0.36 (0.03)	-0.03 (0.03)	-0.04 (0.03)
Risk	-0.02 (0.04)	-0.03 (0.04)	-0.02 (0.04)
Competitiveness	0.00 (0.05)	0.01 (0.05)	0.00 (0.05)
Experimental-level variables			
Tournament incentive	-0.05 (0.10)	-0.04 (0.09)	-0.05 (0.10)
Team incentive	0.05 (0.10)	0.09 (0.10)	0.05 (0.10)
Player's previous shot (scored)	1.25** (0.19)	1.29** (0.19)	1.24** (0.19)
Opponent's previous shot (scored)	-1.01** (0.20)	-1.00** (0.20)	-1.00** (0.20)
Score difference	-0.08 (0.11)	0.00 (0.02)	-0.08 (0.11)
Worthy	0.16 (0.37)	-0.05 (0.07)	0.16 (0.37)
Player A	0.25** (0.08)	1.60* (0.67)	0.35 (0.27)
Locus of control * player A		-0.25* (0.16)	
Self-esteem * player A			-0.02 (0.06)
Self-efficacy * player A			
Self-confidence * player A			
Risk * player A			
Competitiveness * player A			
Tournament incentive * player A			
Team incentive * player A			
Constant	0.90 (0.81)	-4.47 (1.09)	0.64 (0.91)
Statistics			
N (observations)	140	140	140
LR chi2	64.00	67.89	64.15
Log-pseudolikelihood	-65.03	-63.57	-64.96
Prob > chi2	0.0000	0.0000	0.0000
Pseudo R2	0.3298	0.3498	0.3305

Table 6 (continued).

	Model 14	**Model 15**	**Model 16**
	margins	margins	margins
Individual-level variables			
Gender	0.11 (0.08)	0.11 (0.09)	0.10 (0.09)
Age	0.01 (0.01)	0.01 (0.01)	0.00 (0.01)
League	-0.04 (0.04)	-0.04 (0.04)	-0.03 (0.04)
Seven-meter = 1	-0.10 (0.09)	-0.10 (0.03)	-0.13 (0.10)
Seven-meter = 2	0.10 (0.10)	0.06 (0.10)	0.06 (0.10)
Locus of control	0.03 (0.08)	-0.01 (0.08)	0.01 (0.08)
Self-esteem	0.26 (0.03)	0.01 (0.03)	0.00 (0.03)
Self-efficacy	0.26* (0.13)	0.10 (0.11)	0.07 (0.11)
Self-confidence	-0.04 (0.03)	-0.07 (0.04)	-0.03 (0.04)
Risk	-0.02 (0.04)	-0.03 (0.04)	0.02 (0.06)
Competitiveness	-0.02 (0.05)	-0.01 (0.05)	0.00 (0.05)
Experimental-level variables			
Tournament incentive	-0.07 (0.09)	-0.06 (0.10)	-0.06 (0.10)
Team incentive	0.03 (0.10)	0.04 (0.10)	0.04 (0.10)
Player's previous shot (scored)	1.38** (0.19)	1.25** (0.19)	1.24** (0.19)
Opponent's previous shot (scored)	-0.86** (0.21)	-1.04** (0.20)	-1.00** (0.11)
Score difference	-0.08 (0.11)	-0.07 (0.11)	-0.09 (0.11)
Worthy	0.26 (0.37)	0.17 (0.07)	0.14 (0.37)
Player A	1.83** (0.64)	0.64 (0.37)	0.51 (0.34)
Locus of control * player A			
Self-esteem * player A			
Self-efficacy * player A	-0,46* (0.26)		
Self-confidence * player A		0.07 (0.06)	
Risk * player A			-0.06 (0.08)
Competitiveness * player A			
Tournament incentive * player A			
Team incentive * player A			
Constant	-3.91 (2.61)	-0.26 (2.35)	-1.44 (2.30)
Statistics			
N (observations)	140	140	140
LR chi2	69.94	65.45	64.15
Log-pseudolikelihood	-62.07	-64.31	-64.96
Prob > chi2	0.0000	0.0000	0.0000
Pseudo R2	0.3604	0.3372	0.3305

Table 6 (continued).

	Model 17	**Model 18**	**Model 19**
	margins	margins	margins
Individual-level variables			
Gender	0.09 (0.09)	0.10 (0.09)	0.10 (0.08)
Age	0.00 (0.01)	0.00 (0.01)	0.00 (0.01)
League	-0.03 (0.04)	-0.03 (0.04)	-0.05 (0.04)
Seven-meter = 1	-0.12 (0.10)	-0.11 (0.10)	-0.07 (0.09)
Seven-meter = 2	0.05 (0.11)	0.04 (0.11)	0.10 (0.11)
Locus of control	0.00 (0.08)	-0.01 (0.08)	0.09 (0.11)
Self-esteem	0.01 (0.03)	0.01 (0.03)	-0.03 (0.05)
Self-efficacy	0.07 (0.11)	0.08 (0.11)	0.29 (0.16)
Self-confidence	-0.36 (0.03)	-0.04 (0.03)	-0.08 (0.04)
Risk	-0.02 (0.04)	-0.02 (0.04)	-0.01 (0.06)
Competitiveness	-0.01 (0.07)	0.01 (0.05)	-0.01 (0.07)
Experimental-level variables			
Tournament incentive	-0.05 (0.10)	-0.09 (0.14)	-0.14 (0.14)
Team incentive	0.05 (0.10)	-0.09 (0.13)	-0.02 (0.13)
Player's previous shot (scored)	1.25** (0.19)	1.32** (0.20)	1.45** (0.20)
Opponent's previous shot (scored)	-1.01** (0.20)	-1.00** (0.20)	-0.93** (0.21)
Score difference	-0.08 (0.11)	-0.08 (0.11)	-0.03 (0.11)
Worthy	0.16 (0.37)	0.13 (0.36)	0.38 (0.37)
Player A	0.19 (0.44)	0.13 (0.12)	2.12 (0.85)
Locus of control * player A			-0.23 (0.17)
Self-esteem * player A			0.09 (0.07)
Self-efficacy * player A			-0.47 (0.26)
Self-confidence * player A			0.10 (0.06)
Risk * player A			-0.03 (0.08)
Competitiveness * player A	0.01 (0.10)		-0.02 (0.10)
Tournament incentive * player A		0.09 (0.18)	0.12 (0.18)
Team incentive * player A		0.39 (0.16)	0.15 (0.17)
Constant	-0.88 (2.44)	-0.54 (2.30)	-5.08 (3.22)
Statistics			
N (observations)	140	140	140
LR chi2	64.03	67.21	76.26
Log-pseudolikelihood	-65.03	-63.44	-58.91
Prob > chi2	0.0000	0.0000	0.0000
Pseudo R2	0.3299	0.3463	0.3929

Notes: Dependent variable: winner. Standard errors are in parentheses und average marginal effects in margins column. Standard errors are clustered at the player level. Significance levels: ** $p < 0.01$, * $p < 0.05$. The marginal effects of seven-meter remain insignificant if we split the variable into three categories, and the marginal effects of league remain insignificant if we split the variable into seven categories (see Section 3.2.1.). In Models 18 and 19, the command *margins, dydx (*)* was used to calculate the marginal effects of the interaction terms because the command *inteff* can just only compute one interaction effect in a model.

Table 7
The interaction effects of player position (player A) and psychological traits, resp. incentives, on individual performance.

	Model 20	**Model 21**	**Model 22**
	margins	margins	Margins
Individual-level variables			
Gender	-0.10*(0.05)	-0.10 (0.05)	-0.10 (0.05)
Age	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
League	0.00 (0.02)	0.00 (0.02)	0.00 (0.02)
Seven-meter = 1	0.03 (0.05)	0.05 (0.05)	0.04 (0.05)
Seven-meter = 1	0.07 (0.06)	0.07 (0.06)	0.07 (0.06)
Locus of control	-0.01 (0.04)	0.04 (0.06)	-0.01 (0.04)
Self-esteem	0.06**(0.02)	0.06**(0.02)	0.07**(0.03)
Self-efficacy	-0.06 (0.06)	-0.06 (0.07)	-0.06 (0.07)
Self-confidence	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)
Risk	-0.05* (0.02)	-0.05* (0.02)	-0.05* (0.02)
Competitiveness	0.02 (0.03)	0.03 (0.03)	0.02 (0.03)
Experimental-level variables			
Tournament incentive	0.09 (0.05)	0.10 (0.05)	0.09 (0.05)
Team incentive	0.10 (0.06)	0.11 (0.06)	0.10 (0.06)
Throw number	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)
Player's previous shot (scored)	0.03 (0.06)	0.03 (0.06)	0.02 (0.06)
Opponent's previous shot (scored)	0.01 (0.05)	0.01 (0.05)	0.01 (0.05)
Score difference	0.01 (0.02)	0.01 (0.02)	0.01 (0.02)
Worthy	-0.06 (0.07)	-0.05 (0.07)	-0.05 (0.07)
Player A	-0.01 (0.05)	0.52 (0.38)	0.08 (0.16)
Locus of control * player A		-0.11 (0.08)	
Self-esteem * player A			-0.02 (0.03)
Self-efficacy * player A			
Self-confidence * player A			
Risk * player A			
Competitiveness * player A			
Tournament incentive * player A			
Team incentive * player A			
Constant	0.90 (0.81)	-0.04 (1.11)	0.75 (0.84)
Statistics			
N (players)	140	140	140
N (observations)	578	578	578
Wald chi2	39.02	39.92	39.19
Log-pseudolikelihood	-372.46	-371.54	-372.29
Prob > chi2	0.0044	0.0051	0.0063
Pseudo R2	0.0382	0.0405	0.0386

Table 7 (continued).

	Model 23	**Model 24**	**Model 25**
	margins	margins	margins
Individual-level variables			
Gender	-0.10 (0.05)	-0.10*(0.05)	-0.10* (0.05)
Age	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
League	0.00 (0.02)	0.00 (0.02)	0.00 (0.02)
Seven-meter = 1	0.03 (0.05)	0.03 (0.05)	0.04 (0.05)
Seven-meter = 2	0.06 (0.06)	0.08 (0.06)	0.07 (0.06)
Locus of control	-0.02 (0.04)	-0.01 (0.04)	-0.01 (0.04)
Self-esteem	0.06**(0.02)	0.06**(0.02)	0.06**(0.02)
Self-efficacy	-0.09 (0.09)	-0.03 (0.06)	-0.06 (0.07)
Self-confidence	-0.02 (0.02)	-0.05*(0.02)	-0.02 (0.02)
Risk	-0.05*(0.02)	-0.05*(0.02)	-0.05 (0.04)
Competitiveness	0.02 (0.03)	0.01 (0.03)	0.01 (0.03)
Experimental-level variables			
Tournament incentive	0.09 (0.05)	0.09 (0.05)	0.09 (0.05)
Team incentive	0.10 (0.06)	0.09 (0.07)	0.10 (0.06)
Throw number	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)
Player's previous shot (scored)	0.02 (0.06)	0.03 (0.06)	0.03 (0.06)
Opponent's previous shot (scored)	0.01 (0.05)	0.01 (0.05)	0.01 (0.05)
Score difference	0.01 (0.02)	0.01 (0.02)	0.01 (0.02)
Worthy	-0.06 (0.07)	-0.06 (0.07)	-0.06 (0.07)
Player A	-0.30 (0.35)	-0.29*(0.14)	0.00 (0.20)
Locus of control * player A			
Self-esteem * player A			
Self-efficacy * player A	0.10 (0.11)		
Self-confidence * player A		0.06 (0.03)	
Risk * player A			0.00 (0.04)
Competitiveness * player A			
Tournament incentive * player A			
Team incentive * player A			
Constant	1.25 (0.93)	1.32 (0.86)	0.88 (0.91)
Statistics			
N (players)	140	140	140
N (observations)	578	578	578
Wald chi2	41.53	44.53	39.27
Log-pseudolikelihood	-372.10	-370.93	-372.25
Prob > chi2	0.0032	0.0013	0.0062
Pseudo R2	0.0391	0.0421	0.0387

Table 7 (continued).

	Model 26	**Model 27**	**Model 28**
	margins	margins	margins
Individual-level variables			
Gender	-0.10 (0.05)	-0.10* (0.05)	-0.09 (0.05)
Age	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
League	0.00 (0.02)	0.00 (0.02)	0.00 (0.02)
Seven-meter = 1	0.04 (0.05)	0.04 (0.05)	0.04 (0.05)
Seven-meter = 2	0.07 (0.06)	0.10 (0.07)	0.11 (0.07)
Locus of control	0.00 (0.04)	-0.02 (0.04)	0.04 (0.07)
Self-esteem	0.06**(0.02)	0.06**(0.02)	0.07*(0.03)
Self-efficacy	-0.03 (0.06)	-0.05 (0.06)	-0.11 (0.11)
Self-confidence	-0.02 (0.02)	-0.02 (0.02)	-0.06**(0.02)
Risk	-0.05*(0.02)	-0.05*(0.02)	-0.04 (0.04)
Competitiveness	0.04 (0.05)	0.02 (0.03)	0.07 (0.05)
Experimental-level variables			
Tournament incentive	0.09 (0.05)	-0.02 (0.08)	0.00 (0.08)
Team incentive	0.10 (0.06)	0.03 (0.09)	0.04 (0.09)
Throw number	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)
Player's previous shot (scored)	0.03 (0.06)	0.03 (0.06)	0.03 (0.06)
Opponent's previous shot (scored)	0.01 (0.05)	0.01 (0.05)	-0.01 (0.06)
Score difference	0.01 (0.02)	0.00 (0.02)	-0.01 (0.02)
Worthy	-0.06 (0.07)	-0.06 (0.07)	-0.06 (0.07)
Player A	0.16 (0.28)	-0.12 (0.07)	0.19 (0.52)
Locus of control * player A			-0.13 (0.09)
Self-esteem * player A			-0.01 (0.04)
Self-efficacy * player A			0.18 (0.15)
Self-confidence * player A			0.09*(0.04)
Risk * player A			-0.03 (0.05)
Competitiveness * player A	-0.04 (0.06)		-0.10 (0.07)
Tournament incentive * player A		0.20*(0.10)	0.18 (0.11)
Team incentive * player A		0.13 (0.10)	0.11 (0.11)
Constant	0.62 (0.94)	1.28 (0.81)	0.46 (1.28)
Statistics			
N (players)	140	140	140
N (observations)	578	578	578
Wald chi2	39.23	40.83	59.62
Log-pseudolikelihood	-372.25	-370.48	-365.93
Prob > chi2	0.0041	0.0039	0.0003
Pseudo R2	0.0387	0.0432	0.0550

Notes: Dependent variable: Throw success. Standard errors are in parentheses and average marginal effects in margins column. Standard errors are clustered at the player level. Significance levels: ** $p < 0.01$, * $p < 0.05$. Reference categories: Seven-meter = 0, Individual incentive. In Models 27 and 28, the command *margins, dydx (*)* was used to calculate the marginal effects of the interaction terms (Williams, 2012) because the command *inteff* can just only compute one interaction effect in a model.