Role of timeouts in table tennis examined

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Abstract

The purpose of the present study was to examine the role of timeouts in competitive elite table tennis in relation to psychological momentum (PM). To that end, archival data from elite top-international matches \( (N = 48) \) was firstly examined to gather information on when timeouts are most taken, and whether these have any objective influence on subsequent performance (set outcome and ultimately match outcome). Secondly, similar archival data for Swedish League matches \( (N = 36) \) was examined and interviews with elite coaches from the highest Swedish league \( (N = 6) \) at these given matches were carried out to gain further knowledge and understanding on the role and use of timeouts in competitive elite table tennis. Findings showed that timeouts were mostly called following a sequence of three consecutive lost points; that is, coaches used timeouts to break negative PM. However, findings also showed that these given timeouts had no objective impact on neither set nor match outcomes; that is, sets and matches were ultimately lost. Future research examining the subjective coach-player experience revolving around timeouts is needed to comprehend potential ‘secondary’ purposes when calling timeouts and, subsequently, understand timeouts role in table tennis fully.

Keywords: Coaching, match analysis, psychological momentum, scoring outcome, timeout
Sammanfattning

Syftet med föreliggande studie var att studera betydelsen av timeouts inom elit-tävlingsbordtennis i relation till psykologiskt momentum (PM). För detta ändamål studerade författarna först arkivdata från internationella topp elitmatcher ($N = 48$) för att samla information om när timeouts som mest är tagna och om dessa har ett objektivt inflytande på efterföljande prestation (set resultat och slutligen matchresultat). I steg två studerades liknande arkivdata inom svenska seriematcher ($N = 36$) samt intervjuer med elitcoacherna ($N = 6$) för dessa givna seriematcher genomfördes för att ge fördjupad kunskap och förståelse om timeoutens roll i elitbordtennis. Elitcoacherna hade en medelålder på 45.7 ($SD = 11.3$) och en genomsnittlig erfarenhet i coachning på 11.5 år ($SD = 4.9$). Resultatet visade att de flesta timeouts användes i en sequens av tre förlorade poäng i följd; det betyder, coacherna använde timeouten för att bryta negativt momentum. Resultaten visade dock att dessa givna timeouts inte hade någon objektiv påverkan på set eller match utkomsten; det betyder, setet och matchen var i slutändan förlorat. Framtida forskning som undersöker den subjektiva coach - spelare upplevelsen gällande timeouts behövs för att förstå potentiella ”sekundära” syften med användningen av timeouts, för att senare fullt ut förstå timeoutens roll i bordtennis.

Nyckelord: Coachning, matchanalys, psykologiskt momentum, poängresultat, timeout
Which factors are considered to be critical in order to gain psychological advantage towards successful athletic performance? How can this kind of knowledge help coaches and athletes to optimize performance outcomes during competitive situations? Understanding the role of psychological momentum (PM) on athletic performance may help coaches to enhance the quality of practice and coaching effectiveness during competition for subsequent better athletic performance. Den Hartigh and Gernigon (2018) found that PM develops in table tennis when an individual is striving towards a desired outcome. PM is experienced in feelings of control, confidence, motivation, optimism, energy and synchronism (Vallerand, Colavecchio & Pelletier, 1988). Enhanced feelings of control and motivation foster energy for action and increases chances to win matches (Moesch & Apitzsch, 2012). Furthermore, den Hartigh and Gernigon (2018) stated “PM develops more easily when the match is important and the stage of the match is critical” (p. 5).

Nevertheless, views are mixed when it comes to determine the actual influence of PM on performance and whether the concept is real or just an illusion (Crust & Nesti, 2006). Regarding the impact of PM on actual performance, Vallerand et al. (1988) stated “whether based on objectivity or not, these perceptions have real consequences for the person who holds them” (p. 94). Findings in table tennis showed that score configurations have an impact on the perception of PM and, also, that a timeout can break PM (den Hartigh & Gernigon, 2018); table tennis players (n = 80) perceived PM during a recorded audio-video scenario of a table tennis match, and that a timeout changed their PM perceptions. As a result of these findings on PM, den Hartigh and Gernigon (2018) suggested that table tennis coaches could use timeouts to enhance performance. It was suggested that future research could focus on coaches’ perspective of PM (Crust & Nesti, 2006). Following on that, researchers found that the manner coaches perceive PM influences their own behaviour, confidence and emotions (Moesch & Apitzsch, 2012); additionally, Briki and colleagues’ findings suggested that coaches could use timeouts in order to interrupt the opponents positive PM state for subsequent enhanced performance (Briki, Doron, Markman, den Hartigh & Gernigon, 2014). These findings are important for coaches to optimize athletic performance in a highly competitive world of sport; these factors could lead to a more stable psychological state during table tennis performance. The present study explores the role of timeouts in table tennis in relation to PM framework.

**Psychological momentum (PM)**

PM is commonly known as a psychological force mentioned in sport context by athletes, coaches and commentators. In theoretical research, PM is defined as “an added or gained psychological power which changes interpersonal perceptions and influences an individual’s mental and physical performance” (Iso-Ahola & Mobily, 1980, p. 391). Vallerand et al. (1988) conceptualized PM to a perception of moving towards a goal, the given conceptualization was used by different researches who found that PM is related to psychological aspects during a pursuit towards the goal (Adler, 1981; Taylor & Demick, 1994; Vallerand et al., 1988; Gernigon, Briki & Eykens, 2010; Briki et al., 2014; den Hartigh & Gernigon, 2018). The psychological aspects were experienced in feelings of for example higher levels of motivation, control and confidence (Vallerand et al., 1988). Furthermore, the phenomenon of PM is bidirectional, which means that it can be perceived either as positive (e.g., where the performance seems to be approaching the goal), or perceived as negative (e.g., where the performance seems to be erasing the goal). Sport studies on score configurations in tennis (Vallerand et al., 1988) and in table tennis (Gernigon et al., 2010; Briki et al.,
2014; den Hartigh & Gernigon, 2018) found that approaching the goal leads to feelings of confidence, energy and optimism and is therefore experienced as a positive PM. In contrast, erasing the goal leads to an opposite experience of these feelings and is therefore experienced as negative PM. Furthermore, it seems that positive and negative PM occur in the same way but on different opponents, e.g. one opponent experience positive PM whereas the other opponent experience negative PM (Gómez, Jiménez, Navarro, Lago-Penas & Sampaio, 2011). In many sports, coaches try to manipulate PM by calling for timeouts. Den Hartigh and Gernigon (2018) found that timeouts in competitive table tennis leads to a recovery of PM; findings stated that “table tennis players can efficiently use a time-out to overcome their own negative PM and to decrease their opponents’ positive PM” (p. 4). Gernigon et al. (2010) used recorded video scenarios of table tennis matches to measure participants PM perceptions before each played point (competitive anxiety, self-confidence and goal involvement states) while participants were exposed to different score configuration scenarios; one was a match loss scenario whereas the other was a match win scenario. Their findings showed that competitive anxiety and mastery avoidance goals (negative PM) decreased when the match was approaching a winning outcome (Gernigon et al., 2010). Briki et al. (2014) followed up on Gernigon et al. (2010) findings and examined table tennis actors (n = 84) and observes (n = 83) positive and negative PM and their responses to a sudden interruption (i.e., power cut) of PM. Participants were exposed to an audio-visual simulation of a table tennis match with two scenarios; the final set of an important table tennis match beginning at the score of 0-7 (or 7-0) to end with a sudden interruption at the score of 7-7 (Briki et al., 2014). Findings showed that actors and observers experienced that an interruption of a positive PM scenario (0-7 to 7-7) lead to a decrease of PM and that an interruption of a negative PM scenario (7-0 to 7-7) lead to an increase of PM. These findings showed that PM was psychologically neutral interrupted by a power cut, therefore, coaches could consciously interrupt PM by calling for a timeout (Briki et al., 2014).

PM is complex and a challenging concept for researchers and practitioners. In recent years, researchers have tried to conceptualize the phenomenon by using a dynamic system approach (Gernigon et al., 2010). A dynamic system is a complex set of elements that interact with each other where a single variable is not sufficient enough to affect the system in its whole nature (Gernigon et al., 2010). Later research aimed to further examine the possibility of PM as a dynamical system and found results to strengthen the potential relationship (Briki, den Hartigh, Markman, Micallef & Gernigon, 2013). However, the present study does not aim to examine the direct phenomenon of PM. Therefore, it is enough to mention that previous studies showed that PM is a complex and history depended phenomenon (Gernigon et al., 2010; Briki et al., 2013). The authors of the present study will now describe the framework in the present study, previous research in table tennis and finally, rules of table tennis will be presented.

The antecedents-consequences model of psychological momentum

Vallerand et al. (1988) created the antecedents-consequences model of PM to conceptualize the phenomenon of PM into the sport domain (see Figure 1). The present study used the given model regarding its potential to explain both the actors (participant) and observers (e.g., coach or spectator) perspective of PM. To test the potential model of PM, Vallerand et al. (1988) conducted questionnaires with tennis players (N = 44). The questionnaires aimed to examine antecedents and if these affect PM perceptions to finally examine if these PM perceptions and consequences have a subsequent influence on performance inferences. Vallerand et al. (1988) findings showed evidence for the model; antecedents in form of previous experiences in sport
and score configurations affected PM perceptions and performance inferences. The four steps of the antecedents-consequences model of PM will be presented below.

Fig. 1: The antecedents-consequences model of psychological momentum (Vallerand et al., 1988).

The first step in the model, antecedents, contains of situation and person. Situation might mean athletes experiences of given score configuration (script) in a match, or athletes’ decisions of calling a timeout (choice). Person might be related to athletes’ previous experiences within the given sport (experiences), how the athlete lives up to expectations and if the athlete value the feeling of control over a given situation (need for control), or if the athlete is an amateur or expert in the given sport (schemas). The first step within the model, antecedents, will in turn affect feelings and perceptions of PM. These feelings and perceptions might mean athletes motivation, energy and feeling of control in a given situation. For example, if the athlete loses consecutive points and loses the game advantage (script) it might affect the athlete to experience less confidence in a given match situation (control). Furthermore, Vallerand et al. (1988) believes that the perception of control is a crucial factor for PM perceptions. The world of sport is considered to give multiply possibilities to the experience of control, thus, the experience of control infers when individuals are given a choice. For example, table tennis coaches can control how and when the timeout will be used; therefore, timeouts might be an act of control. The last step in the model contains of moderators that will ultimately affect actual performance. The moderators consist of context (i.e., crowd and importance of match) and person (i.e., skill level and need for achievement). Lastly, Vallerand et al. (1988) findings indicated that PM perceptions will subsequent influence performance inferences. For example, if two equal opponents meet in a competitive situation, the opponent who experience positive PM will ultimately win. However, further research is needed to uphold previous statement. Vallerand et al. (1988) suggested future research to continuing investigate the relationship between PM perceptions and actual performance.
Psychological momentum, timeouts and coaches’ role

Den Hartigh and Gernigon (2018) experimental findings indicated that timeouts influenced PM perceptions. Findings showed that PM emerged when score configurations changed, for example, negative PM emerged when a player lost advantage (i.e., 7-1 to 7-7) and positive PM emerged when a player came back from behind in score (i.e., 1-7 to 7-7). Furthermore, a timeout at equal scores of 7-7 lead to a decrease of positive PM and to an increase of negative PM. Den Hartigh and Gernigon (2018) results showed an interesting finding when the score was objectively equal; the score was objectively equal, but the subjective experience of PM was still negative in the increasing scenario and positive in the decreasing scenario. These findings were in line with a previous table tennis study by Gernigon et al. (2010), who found that PM is history-dependent and a complex phenomenon. To that end, the given objective score might not be consistent with the subjective PM experience. Instead, previous history in score configurations is more likely to reflect subjective PM perceptions. Previous research showed that PM can be consciously broken by timeouts (Briki et al., 2014) and that timeouts in table tennis leads to a psychological recovery for subsequent enhanced performance (den Hartigh & Gernigon, 2018). Therefore, timeouts influence on objective performance outcomes is important to further examine. Previous research on competitive basketball showed implications of timeouts influence on subsequent objective performance (Gómez et al., 2011). Findings showed that timeouts had a decreasing effect on opponents positive scoring ratio (Gómez et al., 2011). Coaches are therefore recommended to use timeouts to thenceforth interrupt the opponents winning streak (Gómez et al., 2011). It seems that coaches could use timeouts as a preventive action for subsequent enhanced performance.

Moesch and Apitzsch (2012) qualitative study with handball coaches (N = 9) showed that positive and negative PM could be defined from an observers’ perspective, in the given case, by handball coaches. Thus, the coaches defined positive and negative PM by reading the players body language such as fighting spirit. By that, the coaches perceived a positive PM as a successful performance and a negative PM as an unsuccessful performance. Furthermore, Moesch and Apitzsch (2012) found that an attempt to influence players PM was similar to an attempt to influence players performance. Gained knowledge on coaches’ perceptions of PM could give insight for enhanced performance by the athletes.

Table tennis and the rules of timeout

Table tennis is a fast sport where each played ball respectively leads to a score to the player who won the point. Scoring dynamics can change fast and depend on different variables. These variables can for example be differences in skills or the capacity to regulate psychological factors that in turn affect performance (Liu, Wang & Hsu, 2018). Coaches strive to manipulate these variables to establish a desirable outcome in a given match, either by coaching between the sets or by using a timeout. A table tennis set is over when one opponent wins by the score of eleven and the match is over when one player reaches three (or four) won sets. During the match, each player is allowed a 1-minute timeout per match (ITTF, 2018). The coach (or player) calls for a timeout by a T-sign in any situation in a given match. Rules in table tennis are continuously changing and since the year of 2000 the changes regarding timeout led to new insight in skill, tactical and psychological aspects of table tennis practice (Wang, Chen, Lee & Hsu, 2010). Recently, a new rule on coaching made an impact on competitive table tennis; it is now allowed to coach not only during timeout or set break, but also between the points (ITTF, 2018).
In table tennis, score dynamics makes the management of timeouts a tactical and a crucial choice for coaches. Research in basketball by Gómez et al. (2011) showed that most timeouts were called in the last five minutes, compared to the first thirty-five minutes of a match. Prieto, Gómez, Volossovitch and Sampaio (2016) found similar results and found that coaches usually saves timeouts for the most critical moments in the end of a match. According to Prieto et al. (2016) and Gómez et al. (2011), coaches could improve their handling of timeouts for subsequent enhance psychological and physical performance, if the timeout was called in the right moment.

**Rationale and purpose of the present study**

Den Hartigh and Gernigon (2018) advocated that future studies shall investigate the use of timeouts in actual competitive table tennis and, more precisely, that the coaches’ experience of timeouts in relation to PM warranted full examination. Answering these questions could provide helpful strategies and insights, such as when the timeout is most efficient. Most previous research had a quantitative approach and, therefore, qualitative research was suggested as it can provide a deeper insight into the phenomenon of PM. In a similar line, Crust and Nesti (2006) suggested future research to include the qualitative aspect to investigate coaches’ subjective experiences of PM. Likewise, den Hartigh and Gernigon (2018) advocated future studies to conduct interviews with table tennis coaches when examining timeouts, such as when the timeout was efficient and worked to the coaches’ advantage. Finally, a table tennis study by Briki et al. (2014) stated that “it would be helpful for coaches and athletes to be able to identify the critical moment at which a timeout would be most likely to disrupt both their own phase of negative PM as well as their opponent’s phase of positive PM” (p. 269).

Based on the antecedents-consequences model of PM by Vallerand et al. (1988), the present two-study research views PM from an observer’s perspective and combines both quantitative and qualitative methods. A multiple method is advocated to use when examining either a relatively new area or a complex phenomenon (Malina, Nørreklit, & Selto, 2011); in our case, timeouts in table tennis in relation to the phenomena of PM. To summarize, the overall purpose of the present study was to examine the role of timeouts in elite competitive table tennis and its relation to PM framework.

**Overview of two studies**

The purpose of the present study was to examine the role of timeouts in table tennis and its relation to PM framework in general. To that end, the authors firstly studied archival data from elite top-international matches to gather information on timeouts characteristics and whether these have an influence on subsequent performance in terms of set and ultimately match outcomes (Study 1). Secondly, similar archival data for the Swedish League was studied and confrontational interviews with the elite coaches from the highest Swedish league were conducted. These interviews were carried out to gain further knowledge and understanding on the role and use of timeouts in competitive elite table tennis (Study 2). The authors of the present study decided to structure the whole study by first method, result and discussion for Study 1, followed by method, result and discussion for Study 2. Finally, a general discussion will be provided to address both studies.

**Study 1**

Vallerand et al. (1988) predicts that PM develops in a situation when the match is important. Furthermore, timeouts taken in critical moments might influence PM perceptions and, ultimately, subsequent actual performance (den Hartigh & Gernigon,
2018). Accordingly, Study 1 aimed to examine timeouts in elite top-international competitive table tennis in relation to PM framework. To that end, an overview of timeouts characteristics in elite top-international matches was provided. Furthermore, the present study examined whether these timeouts influence subsequent performance in terms of set, and ultimately match outcomes. In relation to previous research, the authors hypothesized that timeouts would be efficient (i.e., lead to a higher rate of set winnings) if they were used earlier in a given number of consecutive lost points. Finally, findings in the present study are discussed in accordance to the antecedent-consequence model of PM (Vallerand et al., 1988).

Research questions for Study 1:
1. What are the typical characteristics of timeouts in table tennis?
2. How many points are lost before a timeout is called, when is PM broken? If so, is that more likely to occur when experiencing negative or positive PM?
3. What is the actual impact of timeouts on subsequent objective performance (set and match outcome), and its relation to PM?

Method

Sample
Archival data available from male and female 2018 world elite tournaments were used. A total number of 48 matches (male matches 31; female matches 17) from the final stages (from the round of last 16 to finals) were gathered. More precisely, a total of 74 out of the 96 possible timeouts were analyzed, note that in the remaining matches no timeouts were used. Timeouts were taken by both males (47 timeouts used and 14 timeouts unused) and by females (27 timeouts used and 8 timeouts unused). The players’ world rankings from the archival data ranged between #1 to #126 for males ($M = 36.88; SD = 35.46$) and #1 to #200 for females ($M = 27.42; SD = 45.69$). The season of 2018 was chosen because of the new rule regarding timeouts.

Material
The observation method in the present study was partly inspired by den Hartigh and Gernigon (2018) who examined timeouts possibility to affect subjective PM perceptions in recorded audio video competitive table tennis scenarios. Den Hartigh and Gernigon (2018) measured participants PM experience on each played point before a timeout was called. Findings showed that PM emerged when points gradually changed and that PM was broken by timeouts (den Hartigh & Gernigon, 2018). By that, the authors expected that PM emerge in table tennis when points accumulate towards a definite win or lose scenario of the match, and that a timeout affected PM perceptions for subsequent enhanced performance by the individual who called the timeout.

The archival data regarding timeouts were observed and retrieved from the International Table Tennis Federations (2018) website. Archival data was accessed from a computer and gathered from earlier live streams from competitive world class tournaments. The timeouts were not registered elsewhere, therefore the data could not be collected in any other way. To ensure validity the authors of the present study analyzed 4 timeouts (5.4%) together. The authors of the present study created a schedule for timeouts variables used in the present study. See Table 1 for more information regarding variables, classes and definitions.
Table 1

Variables in the present study (both for Study 1 and Study 2)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Classes</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Match outcome</td>
<td>Win / Lose</td>
<td>Win or lose the match when called for a timeout</td>
</tr>
<tr>
<td>Set outcome</td>
<td>Win / Lose</td>
<td>Win or lose the set when called for a timeout</td>
</tr>
<tr>
<td>Timeouts characteristics in given set</td>
<td>Positive, Negative, Neutral</td>
<td>Advantage in score, Behind in score, Equal in score</td>
</tr>
<tr>
<td>Timeouts in given set period</td>
<td>First half, Second half</td>
<td>Up to a score of six, Reaching score of seven or more</td>
</tr>
<tr>
<td>Score configurations before timeouts in given set</td>
<td>L2, L3, L4</td>
<td>Lost up to two consecutive points, Lost three consecutive points, Lost four or more consecutive points</td>
</tr>
<tr>
<td>Score configurations after timeouts in given set</td>
<td>WD, W1, W2, W3</td>
<td>Winning the point directly, Winning after one point, Winning after two points, Winning after three points or more</td>
</tr>
</tbody>
</table>

Design and Procedures

The present study was observational and used archival data. The design was based on a deductive approach inspired by the theoretical framework by Vallerand et al. (1988) and previous research in table tennis by den Hartigh and Gernigon (2018). Archival data was retrieved from ITTF’s (2018) website by using a registered log-in, available for public access. The data was documented on excel sheets by pausing and flushing the video forward and backward to ensure that all data was included. All archival data was observed in a similar way. The data was described in variables (see Table 1). The archival data was observed and documented with following steps;

Step 1. Who was calling for the timeout between player A or B? Note that not all players called for their timeouts. These timeouts were registered as unused timeouts.

Step 2. Was the characteristic of the timeout positive, negative or neutral? If one player had score advantage in the given set, the timeout was classified as positive, for example the score of 6-4. On the contrary, if one player was behind in the given set, timeout was classified as a negative, for example the score of 4-6. Additionally, if the score was equal in given set, the timeout was classified as neutral, for example the core of 6-6.
Step 3. Score configurations in given set before and after the timeouts were registered; six points before and six points after the timeout. After noted score configurations the winning points were marked green and losing points were marked red.

Step 4. The last step was to note if player A or B won or lost the match, followed by if the player won or lost the given set after used timeout. Positive set outcomes caused by timeouts were marked green (i.e., if the timeout lead to a consecutive set winning). On contrast, negative set outcomes were marked with red (i.e., if the timeout lead to a consecutive set loss). Finally, the opponent who won the match was marked with green and the player who lost the match was marked with red.

Data analysis

All data was calculated using Statistical Package of Social Sciences 24.0 (IBM SPSS). To answer the present study research questions of timeouts characteristics, timeouts relation to PM and objective performance, both descriptive and inferential analysis were calculated. In order to examine timeouts impact on objective performance in terms of set outcome and its relation to PM, the authors hypotheses that timeouts lead to a positive outcome of the set when timeouts are used earlier in a given number of consecutive lost points. In this case, positive outcome was defined as winning the given set. To test the hypothesis, a chi- square test was calculated. The group of score configurations before timeouts were compared with set outcome (win or lose set), were the test assuming no differences in between the groups. The test was considered significant at the level of p< .05. If Cramer’s V results in a number close to 1, the authors considered it a strong association between the groups (Field, 2018).

Ethics

This study investigated international top- elite matches; archival data was retrieved from ITTF (2018). The data of the specific matches was treated confidentially. Names of the players who were included in the observation were kept confidential. Lastly, the results from the present study cannot be associated with given world elite tournament.

Results

First, descriptive showed that out of all matches (N = 48), a total of 74 timeouts were used and 22 timeouts were unused. The results of the male timeouts showed that 47 (76%) timeouts were used out of all 62 (100%) possible male timeouts. The results of the female timeouts showed that 27 (79.6%) were used out of all 34 (100%) possible female timeouts. In general, the results of the analysis showed that timeouts were related to match outcomes of 28 (37.8%) match winnings and 46 (62.2%) match losses. Timeouts were also related to set outcomes of 35 (47.3%) set winnings and 39 (52.7%) set losses.

Descriptive on set periods of given timeouts and timeouts characteristics are presented below. In general, most common timeouts were negative timeouts (n = 39; 52.7%). The results showed that timeouts lead to a higher rate of set winnings when timeouts were positive and used in the second half of given set (n = 23; 79.3%). In contrast, negative timeouts taken in first half of given set (n = 26; 78.8%) lead to a higher rate of set losses. For more detailed information see Table 2.
Table 2

Descriptive of timeouts taken in study sample (N = 74)

<table>
<thead>
<tr>
<th>Set period of timeouts</th>
<th>Characteristic of timeout</th>
<th>Set won (n = 35)</th>
<th>Set lost (n = 39)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First half of given set (n = 37; 50%)</td>
<td>Positive timeouts (n = 3; 8.1%)</td>
<td>1 (33.3%)</td>
<td>2 (66.7%)</td>
</tr>
<tr>
<td></td>
<td>Negative timeouts (n = 33; 89.2%)</td>
<td>7 (21.2%)</td>
<td>26 (78.8%)</td>
</tr>
<tr>
<td></td>
<td>Neutral timeouts (n = 1; 2.7%)</td>
<td>1 (100%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Second half of given set (n = 37; 50%)</td>
<td>Positive timeouts (n = 29; 78.4%)</td>
<td>23 (79.3%)</td>
<td>6 (20.7%)</td>
</tr>
<tr>
<td></td>
<td>Negative timeouts (n = 6; 16.2%)</td>
<td>2 (33.3%)</td>
<td>4 (66.7%)</td>
</tr>
<tr>
<td></td>
<td>Neutral timeouts (n = 2; 5.4%)</td>
<td>1 (50%)</td>
<td>1 (50%)</td>
</tr>
</tbody>
</table>

Note: Positive timeouts: Advantage in score; Negative timeouts: Behind in score; Neutral timeouts: Equal in score.

Descriptive on score configurations before timeouts are presented below. Results showed that most common timeouts were used in the given number of three consecutive lost points (n = 33; 44.6%). The results showed that these timeouts lead to a higher rate of set losses (n = 20; 60.6%). See Table 3 for more detailed information.
Table 3

*Descriptive of score configurations before timeouts in study sample (N = 74)*

<table>
<thead>
<tr>
<th>Score configuration before timeouts</th>
<th>Set won (n = 35)</th>
<th>Set lost (n = 39)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L2 (n = 26; 35.1%)</td>
<td>14 (53.8%)</td>
<td>12 (46.2%)</td>
</tr>
<tr>
<td>L3 (n = 33; 44.6%)</td>
<td>13 (39.4%)</td>
<td>20 (60.6%)</td>
</tr>
<tr>
<td>L4 (n = 15; 20.3%)</td>
<td>8 (53.3%)</td>
<td>7 (46.7%)</td>
</tr>
</tbody>
</table>

*Note:* L2: Up to two consecutive lost points before calling a timeout; L3: Three consecutive lost points before calling a timeout; L4: Four or more consecutive lost points before calling a timeout.

Descriptive of timeouts influence on score configurations are presented below. Results showed that most common score configurations after timeouts were winning after one point played (n = 30; 40.5%). These timeouts were also related to a higher rate of set winnings (n = 16; 53.3%). See Table 4 for more detailed information.

Table 4

*Descriptive of score configurations after timeouts on study sample (N = 74)*

<table>
<thead>
<tr>
<th>Score configuration after timeouts</th>
<th>Set won (n = 35)</th>
<th>Set lost (n = 39)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WD (n = 21; 28.4%)</td>
<td>11 (52.4%)</td>
<td>10 (47.6%)</td>
</tr>
<tr>
<td>W1 (n = 30; 40.5%)</td>
<td>16 (53.3%)</td>
<td>14 (46.7%)</td>
</tr>
<tr>
<td>W2 (n = 13; 17.6%)</td>
<td>8 (61.5%)</td>
<td>5 (38.5%)</td>
</tr>
<tr>
<td>W3 (n = 10; 13.5%)</td>
<td>0 (0%)</td>
<td>10 (100%)</td>
</tr>
</tbody>
</table>

*Note:* WD: Winning the point directly after the timeout; W1: Winning after one point played after the timeout; W2: Winning after two points played after the timeout; W3: Winning after three points or more played after the timeout.
The chi-square test was calculated in order to see if timeouts used in an earlier given number of consecutive lost points were related to a higher rate of set winnings. The test showed a non-significant result $\chi^2(2; N = 74) = 1.49, p > .05$. The associations were of a low strength: $\phi = .142$. Further information regarding the counts is available from Table 5.

Table 5

<table>
<thead>
<tr>
<th></th>
<th>Up to two consecutive points</th>
<th>Three consecutive points</th>
<th>Four consecutive points or more</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set winnings</td>
<td>14 (54%)</td>
<td>13 (39%)</td>
<td>8 (53%)</td>
<td>35 (47%)</td>
</tr>
<tr>
<td>Set losses</td>
<td>12 (46%)</td>
<td>20 (61%)</td>
<td>7 (47%)</td>
<td>39 (53%)</td>
</tr>
<tr>
<td>Total</td>
<td>26 (35%)</td>
<td>33 (45%)</td>
<td>15 (20%)</td>
<td>74 (100%)</td>
</tr>
</tbody>
</table>

Discussion

The overall purpose of the present study was to examine the role of timeouts in table tennis in relation to PM. The main descriptive findings with Study 1 were that timeouts were used in a sequence of three consecutive lost points to break negative PM. The chi-square test was not statistically significant and thereby the authors reject the hypothesis; timeouts lead to a positive outcome of the set when timeouts are used earlier in a given number of consecutive lost points.

Previous research by Vallerand et al. (1988) showed that score configurations (situational antecedent) and the importance of the match (context variable) affect perceptions of PM. This was later confirmed by den Hartigh and Gernigon (2018) who found that PM emerge when the opponent is coming from behind (or lost advantage) to tie scores in critical moments in competitive table tennis (i.e., from the score of 1-7 to 7-7). The present study could therefore argue that score configurations in the final stages of elite top- international matches affected PM perceptions in the given study sample. Furthermore, den Hartigh and Gernigon (2018) showed that timeouts break PM and leads to a psychological recovery for subsequent enhanced performance. The present study could therefore argue that timeouts were used to break PM and lead to a more stable psychological state for subsequent enhanced objective performance (score outcomes) after called timeouts. Research questions in Study 1 will be discussed below.

The first aim of Study 1 was to examine typical characteristics of timeouts in table tennis. Gómez et al. (2011) suggested that most timeouts were called in the end of a match, by that, gain physical and psychological benefits in form of enhanced performance in critical moments in the end of a competitive match. The results of the
present study did not support previous results by Gómez et al. (2011). The results in the present study showed equal percentages of timeouts called in the first half of given set as in the second half of given set (see Table 2). These results can depend on the fact that basketball teams are allowed several timeouts each, whereas in table tennis, each player is only allowed one timeout (ITTF, 2018). The results of the present study might be related to the fact that table tennis matches depend on score outcomes (and not time-dependent as in other sports). In competitive table tennis, points are scored in a short period of time and one player can suddenly turn the match around, by that, several variables determine if the match is in a final and critical moment; where it is suggested that most timeouts are called (Gómez et al., 2011). Based on the present study, the most common characteristics of timeouts were negative timeouts in the first half of given set and the second most common characteristics of timeouts were positive timeouts in the second half of given set (see Table 2).

The second aim of Study 1 was to examine how many points were lost before timeouts were called (when PM was broken), and if timeouts occurred when experiencing positive or negative PM. Previous table tennis studies by Gernigon and colleges (2010; 2014; 2018) found that timeouts lead to a recovery of negative PM and to decrease of opponents positive PM. Thus, den Hartigh and Gernigon (2018) recommended coaches to use timeouts more efficient; break their own players negative PM or to break opponents positive PM for subsequent enhanced objective performance (set and match outcome). Findings in the present study indicated that timeouts were called after the given number of three consecutive lost points (see Table 3); by that, timeouts were called in order to break negative PM and to reduce the risk of future consecutive lost points, in contrast, for subsequent enhanced objective (score) performance (Gernigon et al., 2010; Briki et al., 2014; den Hartigh & Gernigon, 2018). Findings in the present study showed that players won points either directly after the timeout or after one ball played, results showed a total percentage of 28.4% on winning directly respectively 40.5% on winning after one point played (see Table. 4). The findings in the present study indicated that the player who called for a timeout broke their own negative PM if score configurations changes from three consecutive lost points to either winning one point directly or after one point played. Thus, changes in score configurations (objective performance) might also lead to a change in subjective PM perceptions, to that end, PM was considered broken. Nevertheless, findings were mixed and lead to the question if timeouts break PM or if the change in score configurations (objective performance) is simply an illusion (Crust & Nesti, 2006).

The third aim of Study 1 was to examine the actual impact of timeouts on subsequent objective performance (set and match outcome), and its relation to PM. Vallerand et al. (1988) hypothesized that the perception of PM will affect actual objective performance. Furthermore, Vallerand et al. (1988) stated that the perception of PM was subjective but could affect objective performance outcomes. Therefore, the authors hypothesized that timeouts lead to a positive outcome of given set when timeouts were used earlier in a given number of consecutive lost points. Given assumption was based on previous research on timeout relation to PM and the dynamics of PM, namely that PM is history dependent and that PM can be broken by timeouts (Gernigon et al., 2010; Briki et al., 2014; den Hartigh & Gernigon, 2018). Gómez et al. (2011) also suggested that timeouts could act as a preventive action for “unanswered points” to avoid future lost points. Nevertheless, the chi-square test (see Table 5) did not showed statistically significant results between the given number of consecutive lost points before called timeouts and set outcome in terms of set wins or losses (objective performance). Previous findings indicated that PM is history dependent, more precisely, the given objective score might not reflect the individuals subjective PM perceptions (Gernigon et al., 2010, den Hartigh & Gernigon, 2018).
Thus, timeouts efficiency depends on the history behind the given score and how the individual experience the given match situation (Vallerand et al., 1988). To that end, timeouts were efficient on breaking negative PM for subsequent enhanced objective performance (set and match winnings) depending on how the individual perceived the history behind the score and the given match situation (importance of the match and achievement of the goal).

In accordance to the antecedents-consequences model of PM (Vallerand et al., 1988), timeouts might be called in order to take (or retake) control over the situation. Control is an antecedent for the perception of PM, ultimately, this makes the use of timeouts in table tennis an important factor on PM perceptions. As mentioned before, results showed that timeouts were called in a sequence of three consecutive lost points to break negative PM. The result in the present study showed that 74 timeouts out of 96 possible timeouts were used. These timeouts were related to match outcomes of 62.2% match losses and 37.8% match winnings, and to set outcomes of 52.7% set losses and 47.3% set winnings. These findings stated the question if timeouts were efficient or not. The fact that timeouts were related to a higher percentage of lost matches and sets could depend on different factors. One factor might be that the player who is superior is not in need of a timeout, in contrast, players who stands for a definite loss uses their timeout as a desperate attempt to turn the match. The timeouts in the present study sample were therefore more likely to represent set and match losses, and a second factor might be that timeouts are an illusion of control and that PM perceptions do not affect objective performances (Vallerand et al., 1988; Crust & Nesti, 2006).

**Study 2**

Moesch and Apitzsch (2012) showed that PM could be defined from an observer’ perspective, e.g. a coach. Their study showed that the coach could define a players positive or negative PM by reading the player’s body language (Moesch & Apitzsch, 2012). The body language could contain attitude and fighting spirit. For example, when the players expressed a behaviour that reflected of confidence, the coach perceived a positive PM. In contrast, when the player expressed a behaviour that reflected of stress, the coach perceived a negative PM. Thus, the coaches expressed a positive PM, for example confidence, as successful in sport performance. In contrast, negative PM, for example stress, was considered as unsuccessful in sport performance. Moesch and Apitzsch (2012) further indicated that the performance of the opponent also played a role on PM perceptions. Moesch and Apitzsch (2012) stated that “a change of the opponent’s tactic or a very successful opponent, were further considered to trigger a negative PM” (p. 443). It seems that subjective interpretations of, for example, facial changes and behaviors contributed to how coaches interpreted positive and negative PM (Moesch & Apitzsch, 2012). Xiao (2015) stated that, if the coach and the player interplay well with each other it could lead to enhanced coaching strategies. For example, if the coach and the player interact well with each other, the coach could increase chances of recognizing negative PM. The coach could then break negative PM by calling a strategic timeout at the right moment.

In study 2, archival data for the Swedish League timeouts were examined in a similar way as in Study 1. Furthermore, interviews with the elite Swedish coaches from these matches were carried out to gain further knowledge and understanding on the role and use of timeouts in competitive table tennis. Findings are discussed in line with the antecedents-consequence model of PM (Vallerand et al., 1988).
Research questions for Study 2:
1. When, how and why coaches use timeouts?
2. Were timeouts perceived to be taken in relation to PM (i.e., to break positive PM of opponent or rather break negative PM of player being coached)?
3. What is the perceived vs the actual impact of timeouts on subsequent objective performance?

Method

Sample
Archival data available from male and female 2018 Swedish league matches were used. A total number of 36 matches (male matches $n = 17$; female matches $n = 19$) from the highest Swedish league were gathered. Out of these 36 matches, a total of 34 timeouts out of 72 possible timeouts were analysed, note that not all players used their timeout. Out of the 17 male matches is was a total of 17 timeouts used and 17 timeouts unused. Out of the 19 female matches it was a total of 17 timeouts used and 21 timeouts unused. One match with two timeouts were missing due to failure in the observed recorded livestream.

The interview participants ($N = 6$) were professional coaches with a mean age of 45.7 ($SD = 11.3$). The coaches were active in the highest Swedish league with a mean experience of 11.5 ($SD = 4.9$) years in professional coaching on elite level. Out of the six male coaches, five were active in male teams and one was active in a female team. The coaches were connected to the same timeouts that were observed in Study 2; the highest Swedish league matches form season 2018.

Material
The observation method in study 2 was completed in the same way as in Study 1 (see Material in Study 1). The observation on archival data from the highest Swedish league matches were partly retrieved from Pingisligan (2018), the remaining matches were observed live by the authors of the present study.

The interviews lasted between 9.20 minutes and 19.16 minutes ($M = 13.73$). The interview guide was constructed by the authors of the present study. The semi structured interview started with background questions and thenceforth followed a chronological order of questions revolving around timeouts (see interview guide in Appendix 1).

Design and Procedure
The present two-study was a mixed-method design and was conducted because of firstly, the present study research questions, and secondly, the limited access to archival data and interview participants. To that end, the authors of the present study collected similar archival data in Study 1 and Study 2, because of the availability of archival data in Study 1. Secondly, the authors conducted interviews with elite coaches from the highest Swedish league because of the availability to interview participants in Study 2.

Study 2 was a mix-method study; the first part was quantitative, and the second part was qualitative. According to Malina et al. (2011), a mixed- method approach provides the best opportunity to answer research questions. The present study included when (quantitative) timeouts were taken and why (qualitative) timeouts were taken. In the quantitative approach, the authors observed key variables revolving around timeouts. In the qualitative approach, the authors acquired a deeper understanding of these key variables revolving around timeouts. The procedure was based on three steps:
Step 1. In similar to Study 1, archival data was retrieved from the public website Pingisligan (2018). Archival data was later transferred in the same variables and same SPSS program as in Study 1 (see Procedure in Study 1).

Step 2. The authors observed three team matches live in order to conduct interviews with the elite coaches. During the live observation, the elite coaches received an information and consent letter from the authors of the present study. The elite coaches were informed that the study was about table tennis. However, to reduce bias the coaches did not get information regarding timeouts.

Step 3. After observing live matches in the beginning of season 2018/2019 and gathering the written consent from the elite coaches, the authors conducted the interviews. The interviews were done by phone call and was conducted close after the match to make it easier for the coach to recall real-life situations. The interviews were done together by the authors where one was leading the interview and one was taking notes. The authors who was taken notes was also able to ask questions that the interview leader might have missed.

Data analysis

The statistical analysis of the archival data was completed in SPSS program in the same way as Study 1 (see Data analysis in Study 1).

The semi structured interviews were partly deductively and inductively analysed by a qualitative content analyse method (Lundman & Hållgren Granheim, 2009). The deductive analysis was based on Vallerand et al. (1988) antecedent- consequence model of PM. The four steps in the model created the higher order themes antecedents, perception of PM, consequences and actual performance. Further, the lower order themes were partly deductive and inductive, the deductive part was based on Vallerand et al. (1988) antecedent- consequence model of PM. Five of the lower order themes were done deductively (choice, experiences, situation, control, game importance) and two of the lower order themes were done inductively (stress and subjective performance). The analyze process included five steps:

Step 1. In the first step, the interviews with elite coaches were transcribed.

Step 2. In the second step, relevant information was separated from irrelevant information. This was done separately by authors, by that, relevant information was later compared to ensure valid and reliable units (Gratton & Jones, 2010).

Step 3. The next step was to create higher order themes based on Vallerand et al. (1988) model. These four themes represented antecedents, perception of PM, consequences and actual performance.

Step 4. The lower order themes were party deductive from Vallerand et al. (1988) model. The inductive lower order themes were created by the authors of the present study. The lower order themes were created from the most mentioned units and gave relevant information to the present study.

Step 5. In the last step, the authors translated the result together from Swedish into English.

Ethics

The ethical guidelines regarding archival data were processed in the same way as in Study 1 (see Ethics in Study 1).

The elite coaches in the qualitative study were informed of their ethical rights before the interviews started (Vetenskapsrådet, 2002). The elite coaches were informed of their rights when they signed the consent letter and before the interviews started (see Appendix 2 and Appendix 3). The ethical guidelines the elite coaches assigned included firstly, their right to information revolving around the present study.
Secondly, the elite coaches’ exclusive right of their own participation, i.e. the participant is entitled to withdraw at any time during the study without a given reason. Thirdly, the information about the elite coaches were treated confidentiality. Lastly, the information from the elite coaches will only be used in connection with the research and nothing else. The elite coaches were also informed about the expected time range of the interview, and also that the interview will be recorded.

Results

Analysis of Swedish league timeouts

Descriptive showed that out of all matches ($N = 36$), a number of 34 (47.2%) timeouts were used out of all 72 (100%) possible timeouts. The results of the male timeouts showed that there were 17 (50%) timeouts used and 17 (50%) timeouts unused. The results of the female timeouts showed that there were 17 (45%) timeouts used and 19 (55%) timeouts unused. The results showed that timeouts were related to match outcomes of winning 11 (32.4%) and losing 23 (67.6%) the match. The timeouts were also related to set outcomes of winning 14 (41.2%) and losing 20 (58.8) the set.

Descriptive of Swedish league timeouts ($N = 34$) are presented below. Results showed that the most common timeouts were negative timeouts ($n = 19; 55.9\%$). Results showed that timeouts lead to a higher rate of set winnings when they were positive and used in the second half of given set ($n = 10; 76.9\%$). In contrast, negative timeouts in first half of given set ($n = 11; 84.6\%$) lead to a higher rate of set losses. For more detailed information see Table 6.
Table 6

Descriptive of timeouts taken in study sample (N = 34)

<table>
<thead>
<tr>
<th>Set period of timeouts</th>
<th>Characteristic of timeout</th>
<th>Set won (n = 14)</th>
<th>Set lost (n = 20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First half of given set (n = 13; 38.2%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Positive timeouts (n = 1; 7.7%)</td>
<td>1 (100%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td></td>
<td>Negative timeouts (n = 12; 92.3%)</td>
<td>1 (8.3%)</td>
<td>11 (91.7%)</td>
</tr>
<tr>
<td></td>
<td>Neutral timeouts (n = 0; 0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Second half of given set (n = 21; 61.8%)</td>
<td></td>
<td>12 (70.3%)</td>
<td>9 (29.7%)</td>
</tr>
<tr>
<td></td>
<td>Positive timeouts (n = 13; 78.4%)</td>
<td>10 (76.9%)</td>
<td>3 (23.1%)</td>
</tr>
<tr>
<td></td>
<td>Negative timeouts (n = 7; 16.2%)</td>
<td>1 (14.3%)</td>
<td>6 (85.7%)</td>
</tr>
<tr>
<td></td>
<td>Neutral timeouts (n = 1; 5.4%)</td>
<td>1 (100%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

Note: Positive timeouts: Advantage in score; Negative timeouts: Behind in score; Neutral timeouts: Equal in score.

Descriptive on score configurations before timeouts are presented below. Results showed that the most common timeouts were used in the given number of two consecutive lost points (n = 15; 44.1%). In similar to study 1 (see Table 3), a sequence of three consecutive lost points before timeouts (n = 14; 41.2%) were related to a higher rate of set losses (n = 10; 71.4%). For more detailed information see Table 7.
Table 7

Descriptive of score configurations before timeouts in study sample (N = 34)

| Score configuration before timeouts | Won set  
(n = 14) | Lose set  
(n = 20) |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>L2 (n = 15; 44.1%)</td>
<td>7 (46.7%)</td>
<td>8 (53.3%)</td>
</tr>
<tr>
<td>L3 (n = 14; 41.2%)</td>
<td>4 (28.6%)</td>
<td>10 (71.4%)</td>
</tr>
<tr>
<td>L4 (n = 5; 14.7%)</td>
<td>3 (60%)</td>
<td>2 (40%)</td>
</tr>
</tbody>
</table>

Note: L2: Up to two consecutive lost points before calling a timeout; L3: Three consecutive lost points before calling a timeout; L4: Four or more consecutive lost points before calling a timeout.

Descriptive on score configurations after timeouts are presented below. The results showed that the most common score configurations were winning the point directly after timeouts (n = 16; 47.1%). These score configurations were also mostly related to set winnings (n = 9; 56.3%). For more detailed information see Table 8.
Table 8

*Descriptive of timeouts effect on score configurations in study sample (N = 34)*

<table>
<thead>
<tr>
<th>Score configuration after timeouts</th>
<th>Won set ((n = 14))</th>
<th>Lose set ((n = 20))</th>
</tr>
</thead>
<tbody>
<tr>
<td>WD ((n = 16; 47.1%))</td>
<td>9 ((56.3%))</td>
<td>7 ((43.8%))</td>
</tr>
<tr>
<td>W1 ((n = 11; 32.4%))</td>
<td>5 ((45.5%))</td>
<td>6 ((54.5%))</td>
</tr>
<tr>
<td>W2 ((n = 2; 5.9%))</td>
<td>0 ((0%))</td>
<td>2 ((100%))</td>
</tr>
<tr>
<td>W3 ((n = 5; 14.7%))</td>
<td>0 ((0%))</td>
<td>5 ((100%))</td>
</tr>
</tbody>
</table>

*Note:* WD: Winning the point directly after the timeout; W1: Winning after one point played after the timeout; W2: Winning after two points played after the timeout; W3: Winning after three points or more played after the timeout.

In similar to Study 1, the chi-square test was conducted in order to see if a timeout in an earlier given number of consecutive lost points was related to a higher rate of set winnings. The test showed a non-significant result \(\chi^2(2, N = 34) = 1.84, p > .05\). The association was of a low strength: \(\phi = .23\). Further information regarding the counts is presented in Table 9.
Table 9

Number of timeouts (%) taken in different score configurations of consecutive lost points with set outcome of either set winnings or set losses (N = 34)

<table>
<thead>
<tr>
<th></th>
<th>Up to two consecutive lost points</th>
<th>Three consecutive lost points</th>
<th>Four or more consecutive lost points</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set winnings</td>
<td>7 (47%)</td>
<td>4 (29%)</td>
<td>3 (60%)</td>
<td>14 (41%)</td>
</tr>
<tr>
<td>Set losses</td>
<td>8 (53%)</td>
<td>10 (71%)</td>
<td>2 (40%)</td>
<td>20 (59%)</td>
</tr>
<tr>
<td>Total</td>
<td>15 (44%)</td>
<td>14 (41%)</td>
<td>5 (15%)</td>
<td>34 (100%)</td>
</tr>
</tbody>
</table>

Interviews with elite coaches

Results from the interviews were presented in four headlines; antecedents, perceptions of PM, consequences and actual performance. The higher order themes (headlines) were created based on Vallerand et al. (1988) antecedents-consequences model of PM (see Figure 2 in Appendix 4). Each higher order theme is presented from the most mentioned data units to the least mentioned data units. The participants (coaches) from the interviews were named C1, C2, C3, C4, C5 and C6. Results from the interviews are presented below.

Antecedents. The results showed that antecedents were the most mentioned PM experience with 75 mentioned data units (see Figure 2 in Appendix 4). In order to understand how the coach work with agreements regarding timeout, the authors asked the coaches if they discuss coaching and timeouts with their players. The coaches perceived that agreements regarding timeouts are necessary. Furthermore, several of the coaches mentioned that agreements regarding timeouts occur as already before the seasons starts. C4 mentioned: “…yes, well we discuss it with all players in the team before the seasons starts, if they want me to take the timeout, if they want to take it by themselves or if we should take it together”.

Furthermore, the coaches explained that timeouts agreement could provide benefits in the coach- player cooperation. Lastly, coaches explained that all players work differently and therefore it is important to get to know each player.

In order to understand why the coaches used a specific timeout, the authors asked why the timeout was used. Several of the coaches mentioned different examples, such as breaking patterns. One coach also mentioned: “…mostly to break momentum” (C2). Another coach also explained that the timeout was used in order to recharge the players energy: “…he needed to breathe for a while/…/ I think that he had to calm down, how can I express myself, he needed to recharge his energy” (C6).

Something that appeared in the interviews were that timeouts mostly used when the players lost three consecutive points. Thus, it seems that elite coaches from the
Swedish league usually use the timeout in this situation. C2 explained: “…when you are behind with three points, it is a classic table tennis timeout that you use”. At the same time, there were different opinions on when there is the right moment to call for timeouts. Based on coaches’ previous experiences, timeouts are usually called too late; C1 expressed: “…I mean, it is important to not use the timeout too late, if the result does not go in the right direction, you may feel that you should have used the timeout a few points earlier”.

Further, the coaches experienced self-doubt before deciding to call for timeouts, C1 said: “…it may happen that the opponent gets from 9-3 to 9-5 with two long rallies and nice points. Thence, it is not for sure that you would use the timeout because your player may still play well. In that case, you might wait a few points more before you stop the game”.

In order to further understand the importance of using timeouts, the authors asked about their general thoughts of what is important when using timeouts. There were different answers regarding this item. One coach mentioned that it is important to use both positive timeouts while one coach mentioned that he preferred positive timeouts, and that he could called for the timeout in the first given set of a match. Another coach further explained the importance of acting positive in a timeout situation with following example: “…you push on what the player is doing well and what he was doing good during the match, you encourage that. It is a lot of mental encouraging when you talk, you highlight the positive things” (C1). Another important factor was how coaches mediates information in given timeouts. Coaches perceived controlling, careless and overwhelming coaching could confuse the player; C3 explained it: “…I usually focus on one or max two things, too much information is not good”.

Perception of PM. The result showed that coaches experienced perceptions of PM with 19 data units (see Figure 2 in Appendix 4). The participants in the interview did also explained how they perceived the player in that moment the timeout was used. Several of the coaches mentioned that the player did not have control and therefore a timeout was used. Another coach also mentioned that he perceived that the player did have control which he expressed that the timeout was not necessary. The perception of lack of control was mostly perceived in stress; timeout was consequently used to reduce stress and regain control. Another finding showed that coaches perceived stress to increase in close games, C4 explained it like this: “…if you are in advantage with 10-6 and you lose some points, that might be extra stressful moments. There are still many points to go but if the score would lead to 10-7, 10-8, the stress will increase even more”.

Consequences. The result showed that coaches mentioned consequences with three data units (see Figure 2 in Appendix 4). There were some examples mentioned were the coaches thought it was important to win. Coaches could also experience consequences when the points after the timeout was believed to be important One coach believed that the points after the timeout was used was important. C2 said: “…the points after timeouts are important in order to get energy back out in the game”.

Actual performance. In context to actual performance, coaches had different opinions on the efficiency of timeouts. The result showed that coaches mentioned timeouts outcomes and performance with nine data units (see Figure 2 in Appendix 4). The coaches explained that the given match and set outcome determined if the timeout was either efficient or inefficient. One coach said that: “…yes, absolutely! /.../ the
player closed the match quite fast after the timeout, it was a good timeout” (C4). In contrast to C5 who explained an inefficient timeout as: “…it was absolutely not /…/ From 1-4 to 5-11, that is not efficient”.

Further, one coach explained that it was difficult to determine if the timeout was either efficient or inefficient. C1 mentioned: “…even if I would use the timeout or not, he might have won anyway " (C1).

At the same time one coach explained that inefficient timeouts might depend on the opponent, and if the player performed as expected. Coaches mentioned moments were the other player clearly performed better; timeouts were thereby inefficient.

**Discussion**

The purpose of Study 2 was to further examine the role of timeouts in table tennis and its relation to PM. Den Hartigh and Gernigon (2018) suggested that future research shall examine timeouts in relation to PM on actual table tennis matches. Furthermore, Crust and Nesti (2006) stated similar directions, namely that existing studies lacked qualitative findings. For example, it could be beneficial to investigate coaches’ perceptions of PM and when a timeout turned out to be efficient and worked in their favour. The chosen method in Study 2 allowed the authors to do that. Study 2 was a mixed method study whereby the authors firstly examined archival data from the highest Swedish league matches. Furthermore, the authors conducted interviews with coaches from the given highest Swedish league matches. The results are discussed according to the antecedent-consequence model PM (Vallerand et al., 1988).

The first aim of Study 2 was to answer the research question when, how and why coaches used timeouts. Xiao (2015) suggested that having a dialogue between the coach and the player could imply a positive advantage. Agreements regarding coaching style and the use of timeouts appear to become more important for the interaction between the player and the coach, especially if the player and the coach are new to each other. Firstly, we found how coaches are using timeouts. Coaches perceived that agreements between the coach and the player is important in table tennis. These agreements considered aspects of coaching and the use of timeouts. In the present study we found that agreements between the coach and the player is important, mostly for the coach. Knowing how the player wants to be coached will make it easier for the coach how work with the timeout. Previous research found that a timeout can be useful in that context you need to stop the own negative scoring ratio (Prieto et al., 2016; Gomez et al., 2011). In the present study, coaches mentioned the importance of being positive during the timeout. Thus, a coach with a behaviour of being positive might especially be important for a player in a negative scoring ratio. In the present study we could find when coaches are using timeouts. Prieto et al. (2016) indicated that coaching and timeouts can be associated to strategic reasons by waiting for the timeout until the critical situations at the end of the match. Waiting for the timeout could also depend on the fact that in table tennis, only one timeout is allowed to use (ITTF, 2018).

According to the quantitative data, there were small differences when coaches used timeout at two consecutives lost points and three consecutives lost points (see Table 9). According to the qualitative data, most of the timeouts were used when the player lost three consecutive points. One coach mentioned that these timeouts (lost three consecutive points before timeout) could be seen as a classical table tennis timeout. Moreover, we found one interest finding related to these results. One coach mentioned that he preferred positive timeouts. Several coaches also mentioned that timeouts should be taken earlier. Nevertheless, most of the timeouts were negative timeouts according to the quantitative data (see Table 6) and the qualitative results.

Furthermore, there were suggestions from the coaches on why they sometimes wait to use the timeout. Coaches mentioned that sometimes your player still perform good in
that context that the timeout will not be necessary. At that time, coaches simply wait for the next few points. Coaches also mentioned that timeouts are usually taken too late were there may be regrets. Furthermore, we found more information why coaches are using timeouts. This will be more discussed below in research question 2.

The second aim in Study 2 was to answer the research question if timeouts were perceived to be taken in relation to PM. Den Hartigh and Gernigon (2018) found that the timeout will not be necessary. At that time, coaches simply wait for the next few points. Coaches also mentioned that timeouts are usually taken too late were there may be regrets. Furthermore, we found more information why coaches are using timeouts. This will be more discussed below in research question 2.

The second aim in Study 2 was to answer the research question if timeouts were perceived to be taken in relation to PM. Den Hartigh and Gernigon (2018) found that timeout can break PM. The present study confirmed that coaches used timeouts in relation to perceived PM. Coaches explained that a timeout is useful in order to break patterns or to get a stop in the match. According to Vallerand et al. (1988) model, PM is affected by antecedents, e.g. situation. Nevertheless, it can be difficult to determine exactly which these PM triggers are (Gernigon et al., 2010). Furthermore, Vallerand et al. (1988) indicated that observers may not feel PM on the same level as the actors. This can intend to make it difficult for coaches to recognize negative momentum. For that reason, it can be difficult to determine when the right moment is to take a timeout. A coach that develops experience and an academic education might interpret and recognize PM better (den Hartigh & Gernigon 2018). In the present study, we found that coaches perceived different perceptions of PM. There were some interesting findings related to this context. Firstly, it seems that coaches perceived stress as the most common perception of PM. Besides, stress seems to increase while the player who is in charge starts to lose points. These findings were in line with den Hartigh and Gernigon (2018) who indicated that history (one player is coming from behind) could affect PM. Moreover, Moesch and Apitzsch (2012) believed that feelings such as stress can be an occurrence factor related to negative PM. By that, it seems that coaches perceived emotions and body language such as stress as negative PM. Furthermore, a coach or a player who perceive stress might further use the timeout in order to take (or retake) control of the match (Vallerand et al, 1988). Another interesting finding was that one coach mentioned that players usually gets a higher pulse rate in the final stage of a match. Vallerand et al. (1988) argued that game importance of match can affect PM and actual performance. The pulse rate may increase at the final stage of a match since the match might perceiving to become more important in that moment the match nearly is over. Thus, it seems that the coaches perceived negative PM in term of stress when the timeout was used.

Our third aim in Study 2 was to answer what is the perceived vs the actual impact of timeouts on subsequent performance. According to the quantitative data, the chi-square test did not show statistically significant result between score configuration before timeouts and set outcome (see Table 11). Result showed that in general of Swedish matches 32,4% timeouts were related to winning the match and 67,6% were related to losing the match. Additionally, 41,2% timeouts were related to winning the set and 58,8% were related to losing the set. Thus, mostly of the timeouts were related to losing matches.

According to the interviews, coaches perceived an efficient timeout related to winning outcome. On the contrary, an inefficient timeout perceived to be related to losing the set or match. There were no differences between the winning matches and the losing matches except, positive timeouts were mostly related to winning matches and negative timeouts were related to losing outcome. However, negative timeouts were mostly taken. As mentioned earlier, coaches explained that timeouts are usually taken too late. This could be a main reason why our result showed that most negative timeouts were taken. On the other hand, coaches seem to be conscious that positive timeouts should be used. Coaches mentioned whether a timeout becomes efficient or not could depend on other factors too. E.g. one coach explained that the match outcome can simply depend on that the opponent player was better. This result could be related to Moesch and Apitzsch (2012) who advocated that you should always take
into account the opponent's level as it is an important factor for positive or negative PM. In addition, one coach mentioned that it's difficult to know if the timeout was efficient. In fact, you really don't know if the timeout actually was necessary.

**General discussion**

The purpose of the present two-study research was to examine the role of timeouts in table tennis, and its relation to Psychological Momentum (PM) framework. The main finding was that most timeouts were called after a sequence of three consecutive lost points in order to break negative PM. The authors did not find a statistically significant interaction between earlier called timeouts in consecutive lost point scenarios and set outcome (win or lose the set). Findings from both Study 1 and Study 1 showed that negative timeouts were most commonly called. Nevertheless, coaches suggested to call positive timeouts; in accordance to our findings positive timeouts were also related to a higher percentage of match and set winnings. We will now further discuss general findings on timeouts role in table tennis.

Firstly, results showed that both studies provided similar statistical results, and therefore, we could state that timeouts were used in a similar way in elite-top international matches as in Swedish league matches. However, it seems that elite top-international timeouts were called more frequently than Swedish league timeouts. Furthermore, timeouts impact on actual performance in terms of set and match outcomes were related to a higher percentage (approximately 10%) of winning in the elite top-international timeouts compared to the Swedish league timeouts.

Secondly, results showed that timeouts impact on objective performance in terms of set and match outcomes was a complex subject. Crust and Nesti (2006) stated that researchers are not unanimous when it comes to confirm whether PM influences objective performance. The present research did not find a statistically significant result on earlier timeouts on a given number of consecutive lost points and set outcomes; the authors could, therefore, reject the hypothesis. That is, earlier called timeouts were not related to set winnings (objective performance). The coaches in the Swedish league reported in a similar way, namely that a timeout is efficient when the player wins, and inefficient if the player loses. Given results indicate that timeouts might be an illusion of control (Vallerand et al., 1988) and that PM influence on actual performance is a fantasy (Crust & Nesti, 2006). Nevertheless, timeouts were called in most cases, which indicates that timeouts have an important subjective role in table tennis, and thus that they may have a secondary purpose in competitive table tennis.

**Strengths and limitations**

The authors in the present study are familiar with the given sport. This could be seen as a strength because the authors could formulate relevant research questions for the purpose of the present study. Timeouts in relation to PM is an unexplored area, therefore a mixed-method approach is advocated to use (Malina et al., 2011). The present study used both a quantitative and a qualitative approach and this process was considered a strength for the present study. The qualitative interviews allowed the authors to gain a deeper understanding on the role of timeouts in table tennis. The analysis of the interviews was completed together by both authors. This process was perceived as a strength because the authors could discuss findings from different perspectives.

The authors considered the quantitative sample size to be small and a limitation in the present study. The samples size might not therefore reflect the population or be statistical relevant. Thus, the statistical results are dependent on the sample size (Field, 2018). However, timeouts were not registered in advance and could therefore not be collected in any other way except of observations, the data collection was thereby to
time consuming for a larger sample size. The authors did only measured score configurations in the given set when timeouts were used. This could be seen as a limitation because set configurations were not considered. Another limitation regarding the sample was that timeouts did not represent close games. This was considered a limitation because close games in critical competitive situations affect PM in a higher rate (Gernigon et al., 2010; Briki et al., 2014; den Hartigh & Gernigon, 2018), which might have affected the results in the present study. Another limitation from the interviews was that all participants were male coaches whereas Lundman and Hållgren Graneheim (2009) advocated that the participants should consist of both males and females to strengthen the result. However, the participants had an average of 11.5 years’ experience in coaching which the authors considered to be a strength in the present study.

Applied implications

Based on previous research, table tennis coaches could enhance physical and psychological performance by calling for timeouts (den Hartigh & Gernigon, 2018; Gomez et al., 2011). Nevertheless, objective findings in form of descriptive data and chi-square analysis of timeouts do not support this assumption; that is, most sets and matches were ultimately lost. However, the present two-study findings suggest coaches to use more positive timeouts. Furthermore, a sequence of three consecutive lost points were related to the highest rate of set losses and a timeout at two consecutive lost points were related to a higher rate of set winnings. Thus, the authors suggest coaches to call for more positive timeouts and consider score configurations when calling for a timeout.

PM perceptions depend on the importance of the goal and the given situation at hand (Vallerand et al., 1988). During the interviews, coaches referred to the importance of a good interaction in the coach-athlete relationship and to understand each player special needs. Therefore, the authors suggest coaches to create an open collaboration revolving around coaching strategies and timeouts. Besides, a timeout might have an important secondary purpose; timeouts might create thoughtfulness and faith, which could benefit the interaction between the player and the coach. Finally, table tennis tournaments’ organizers are suggested to gather data on timeouts for players and coaches to better understand the use of timeouts.

Future research

It would be interesting to investigate timeouts efficiency (set and match outcomes) in actual competitive table tennis matches, when (a) the match is critical, (b) the match is in a final moment and (c) the players are of a similar level. By doing so, one will be able to determine variables that might have affected the results in the present research. Furthermore, it would be interesting to interview female and male players and coaches on goal setting, since PM revolve around the goal to be achieved. The present study had a observers’ perspective (i.e., coaches’ or spectators’ perspective) and it would be interesting to further examine players perspective on timeouts role in table tennis. Finally, it would be interesting to further examining secondary purposes of timeouts in table tennis.

Final conclusion

The main finding of the present two-study research was that coaches called for timeouts in a sequence of three consecutive lost points to break negative PM. However, these timeouts had no objective influence on performance in terms of set and match outcomes; timeouts were related to a higher percentage of both set and match losses. Based on the current findings, timeouts objective influence on performance (set and
match outcomes) might be an illusion, or simply a coach’s post-performance explanation of control. Nevertheless, timeouts may play an important coach-athlete subjective role in table tennis. Future research examining such subjective role of timeouts within the coach-player experience and potential secondary purposes for calling a timeout could help to fully understand timeouts potential in competitive table tennis.
References


Appendix 1

Interview guide elite coaches (intervjuguide elitcoacher)

1. Bakgrund om coachen
   - Hur gammal är du?
   - Anser du att du är en man, kvinna eller annat?
   - Hur ser din utbildningsbakgrund ut?
   - Hur länge har du arbetat som coach?
   - Är coach ditt huvud yrke eller har du ett annat yrke också?
   - Hur länge har du coachat på den nivå som du coachar på idag?
   - Hur länge har du coachat ditt lag som du är aktiv i nu?

2. Överenskommelse om timeout (innan match)
   - Har du diskuterat coachning och timeouts med dina spelare innan en match?
     Hur och vad har ni pratat om då?
   - Har ni diskuterat om det är du eller spelaren som beslutar om en eventuell timeout, om ja, hur? Om nej, varför?

3.1 Beslutsfattande timeout (innan timeout)
   - I matchen mellan A och B tog du/spelaren timeout vid ställning xx, kan du förklara varför du/spelaren tog den timeouten?

3.2 Under timeout
   - Kan du förklara vad som förekom i samtalet under timeouten?
   - Pratade du om det som du och spelaren hade kommit överens om innan matchen (dvs om du och spelaren hade kommit överens om något specifikt innan)?
   - Fanns det någonting som du inte fick sagt under timeouten och i så fall varför?

3.3 Efter timeout
   - Setet avslutades sedan med (x-x). Var timeouten effektiv och isåfall varför?

3.4 Efter match
   - Med matchresultatet i hand (resultatet i siffror), hade du tagit samma timeout igen? Om ja, varför? Om nej, vad hade du gjort annorlunda och i så fall hur?

4 Generell fråga om timeout
   - Generellt sett, vad anser du som coach är viktigt att tänka på gällande timeout?
   - Innan vi avslutar intervjun, är det något du vill tillägga?
Appendix 2

Observationer av världseliten och av svenska pingisligan samt intervjuer med svenska elitcoacher inom bordtennis

Vi som genomför den här studien heter Michaela Karlsson och Alexandra Sandéhn och är studerande på högskolan i Halmstad på programmet professionell idrottskarriär och arbetsliv. Den studie som vi genomför är en c-uppsats för en kandidatexamen i idrottsvetenskap.

Syftet med den här studien är att undersöka resultat inom bordtennis från världseliten och svenska pingisligan samt att undersöka svenska tränarens inflytande på resultatet.


Konfidentialitet eftersträvas i undersökningen genom att ingen obehörig får ta del av materialet. Materialet förvaras så att det bara är åtkomligt för oss som är undersökningsledare, samt för våra handledare. I resultatrapporneringen kommer informanterna att avidentifieras så att det inte går att koppla resultatet till enskilda individer. Ditt deltagande i studien är helt frivilligt. Du kan när som helst avbryta ditt deltagande utan närmare motivering. Du har även rätt att få ta del av studien efter att den är godkänd och klar. Ytterligare upplysningar om studien kan lämnas av oss vid önskan och vi som genomför studien kan nås på:

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Tele: 0767749105

Handledare: Dr Xavier Sanchez:
Email: xavier.sanchez@hh.se
Tele: 0766083443

Tack på förhand!
Appendix 3

**Information om samtycke**

Genom att ge din namnteckning bekräftar du att du har tagit del av ovanstående information gällande vilka uppgifter som samlas in, vad uppgifterna används till, hur uppgifterna förvaras och att du har möjlighet att begära att få ta del av uppgifterna. Ditt deltagande är frivilligt. Du har även möjlighet att avbryta ditt deltagande utan att motivera varför samt att du även kan vända dig till dataskyddsombudet eller Datainspektionen vid klagomål.

Genom din namnteckning bekräftar du att:
Du har tagit del av informationen ovan och ger ditt samtycke till att delta i studien

Namnteckning: __________________________________________ Datum ___
<table>
<thead>
<tr>
<th>Data units</th>
<th>Lower order theme</th>
<th>Higher order theme</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>I take the timeout to break psychological momentum (20)</td>
<td>Choice (54)</td>
<td>Antecedents (75)</td>
<td>Coaches timeouts experiences (223)</td>
</tr>
<tr>
<td>Coach – athlete timeouts agreements (13)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>It’s important to act positive (9)</td>
<td></td>
<td></td>
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<tr>
<td>I mediate max 1-2 details during the timeout (4)</td>
<td></td>
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<tr>
<td>I take the timeout because to recharge mentally (3)</td>
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<tr>
<td>I wait for the timeout (2)</td>
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<tr>
<td>I prefer positive timeouts (2)</td>
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<tr>
<td>I prefer both negative and positive timeouts (1)</td>
<td></td>
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<tr>
<td>The timeout is usually taken to late (13)</td>
<td>Experiences (13)</td>
<td></td>
<td></td>
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<tr>
<td>Losing 3 consecutive points before timeout (7)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>He was stressed (11)</td>
<td>Stress (11)</td>
<td></td>
<td>PM perceptions (19)</td>
</tr>
<tr>
<td>He did not have control (7)</td>
<td>Control (8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>He had control (1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winning was the most important (2)</td>
<td>Game importance (3)</td>
<td></td>
<td>Consequences (3)</td>
</tr>
<tr>
<td>Winning the points after timeout is important (1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The timeout was effective (4)</td>
<td>Subjective performance (9)</td>
<td></td>
<td>Actual performance (9)</td>
</tr>
<tr>
<td>The timeout was ineffective (2)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>It’s hard to answer (1)</td>
<td></td>
<td></td>
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<tr>
<td>The player performed as expected (1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The other player was better (1)</td>
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</tbody>
</table>

*Figure 2 – Coaches timeouts experiences*
Alexandra Sandéhn

Michaela Karlsson