Designing the Next Generation of Activity Tackers for Performance Sports: Insights from Elite Tennis Coaches

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ABSTRACT

Wearable sport technologies and activity trackers help sportspeople by providing physiological information on their performance. However, professional sportspeople find this information irrelevant due to their high-performance training. They want these devices to provide real-time assistive feedback on their performance, despite the formidable limitations suggested by previous research on giving such feedback. On the other hand, sport coaches already give performance feedback to their sportspeople during their performance.

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KEYWORDS
Sports performance; real time feedback; elite coach; tennis; activity trackers.

We speculated that some of their approaches might give clues for designing activity trackers with useful real-time performance feedback. Consequently, we interviewed six elite tennis coaches to explore their approaches of communicating performance information to their players, during tennis games. In this paper, we discussed the findings by comparing them with related work and formed two design insights for giving real-time performance feedback that might lead to novel approaches for activity trackers.

INTRODUCTION

Wearable technologies for sports, specifically activity trackers, are proposed to enhance the performance of sportspeople by providing performance feedback. However, early abandonment rates of these devices are up to 34%. Previous studies investigated the issue in terms of the quality of the provided data. [8] emphasized that sports people evaluate the feedback as irrelevant and not actionable. In our previous work, we brought the topic to professional athletes. Data collected from 20 professional tennis players suggests that these players indeed find no meaning in the presented data [5]. They either have a high-performance training routine which ensures them to put enough physical effort, or they have their coaches to provide the necessary feedback. However, this information exchange is only available during training. During a tennis game, players cannot communicate with their coaches or with any other supporting device. Even though they can track their behavior during training, it is extremely difficult to track or recall how they perform on court, because they feel too stressed and anxious. Therefore, they rather want to know how they behave and perform during the game, instead of raw physical data provided by activity trackers.

The sports literature highlights the importance of receiving real-time feedback on players' performance development (i.e. adjusting their game plan) [10]. However, previous research on giving real-time performance feedback presents inherent challenges, such as the cognitive overload caused by giving excessive information or distraction caused by the high demand of attention [1,7,10,11,12]. Generally, activity trackers provide real-time information on the achievements of the users (i.e. you burnt X calories, ran Y kilometers) [11]. While attaining this information is beneficial for players to learn skills, it is also cumbersome to collect and analyze this information in real-time. On the other hand, coaches usually give real-time feedback on the characteristics of the performance (i.e. you executed that forehand perfectly). This information is based on observation, usually communicated verbally and thought to be beneficial when it is hard to track the performance. As coaches already give performance feedback to their players in real-time, we were curious if some of their approaches would help to inspire the design of next generation activity trackers with useful real-time performance feedback. To this end, we interviewed six elite tennis coaches to learn how they give sports performance feedback to their players during tennis games. As a result, we created two design insights that might point out novel directions for current tennis wearable devices and activity trackers. We believe the results can be extended to various sports that have similar challenges as tennis, as well as inform feedback designers of the HCI community.

1.	How long have you been playing tennis?
2.	How long have you been coaching?
3.	How many players are you coaching this year?
4.	What do you pay attention during a tennis game?
5.	What do you pay attention in your player during the game?
6.	What do you pay attention to in the course of the game?
7.	How do you measure your players' performance during a game?
8.	How do you give feedback to your players during a game?
9.	How do you make your players perform better during a game?

Table 1: The interview questions.

*Turkish Tennis Federation has a deep-rooted past since 1953. It holds both national and international tournaments, collaborating with International Tennis Federation. Currently, it is comprised of over ten thousand licensed players and approximately one hundred fifty clubs.

INTERVIEWS

We conducted in-depth interviews with 6 elite coaches (All male, *M*age=42.6 *SD*age=8.9). Elite coaches train high performance professional players, who play for national teams [8]. For example, one of these coaches was a member of International Tennis Federation, who trained with world famous Raphael Nadal. The coaches were well-experienced in tennis (*M*=28.6, *SD*=10.8, in years), as well as in coaching (*M*=20.7, *SD*=10.9, in years). We should note that it was highly challenging to find and interview even a single elite coach. We recruited the licensed coaches through Turkish Tennis Federation*. We asked them about their tennis and coaching experience, their approaches to track their players' performance and their approaches to give feedback to their players during a game (Table 1). Each coach signed a consent form and we recorded the interviews with a camera.

RESULTS

We formed themes to summarize the interview outcomes. Note that it is forbidden to give feedback to players during the game in professional tennis. However, the coaches have their approaches to communicate the necessary information.

Knowing the Player

All coaches indicated that, to be able to provide useful feedback, they focus on tracking their players' behavior, such as their routines and body language. Only p3 mentioned the score. According to p2, "The duty of the coach is to control the players' behavior, and to make the player think of his own plan". Thus, p1 added, "The best coach is the one who knows his player the best".

Positive Reinforcement

The coaches said they would refrain from giving detailed information during the game. Instead, they prefer to orally motivate the player by saying "Keep up the good work. You are doing great"- p2, so the players would be aware of their good performance. Instead of giving negative feedback, the coaches prefer to say, "Come on, you can do better"-p6.

Intervention, Raising Awareness and Reflection

The coaches only intervene when things are out of control. According to p6 "[the players] do not recognize when they lose control". In this case, "Leaving them alone does not work"-p3. For intervening, the coaches give pre-defined signals in the form of eye contact, hand gestures, or shouting. The players take water or injury breaks, when they realize these signals. Even during these breaks, the coaches refrain from giving detailed tactics. They think detailed information will overwhelm the players and in return the players will be troubled to figure out what they should do.

According to the coaches, the reason behind their interventions is to raise the awareness of the players. They confirmed that players have hard time keeping track of what they are doing on court.

However, telling exactly what the players are doing or should do has its downfalls. p5 stated "If I say what he needs to do and he fails to do so, he will never listen to me again". The coaches think that the players need to decide what they should do. According to p6, "Elite players find their own solutions." Thus, the coaches only point directions to the players' performance and expect them to reflect on that information. For example, p4 said, "If the player is on defense and understands that he is not doing well, then he should know that he needs to try playing more aggressive."

Attention

The coaches mentioned the importance of keeping the attention in the game. They think the player needs to fully concentrate on the game and should not pay attention to anything else. For instance, p3 only intervenes "…when the player looks at their parents, the sky or [him] me". This means, "They seek for additional support" and "If the coaches show anxious mimics, the players would understand something is wrong and get nervous"-p5. Thus, coaches try to hide their expressions.

Elaboration After the Game

All coaches take extensive notes during the game. Through these, they share their detailed observation. They utilize squads not to quantify the actions, but to prove what the player lacks as p6 reflects, "It is important for him to see what he did not do instead of what he did". Furthermore, they do not share the squads right after the game, especially when the player has lost. p3 mentioned he even evades his players. According to him, "The player comes when he is ready."

DISCUSSION

Our goal is to inspire the design of future activity trackers by exploring elite tennis coaches' approaches for giving feedback during tennis games. In this section, we present two design insights and discuss the interview findings by comparing to previous research.

During the activity, performance feedback should be in low-resolution, make the player be aware of their own performance and initiate reflection.

The most interesting finding is the content of the information that the coaches prefer to share. Both the sports research and commercial activity trackers converge on giving more detailed and diverse information [1]. However, during the games the coaches prefer to give low-resolution feedback with motivational quotes, and from that they expect players to find their own solutions. Confirming their approach, previous research shows that presenting excessive information during attention demanding activities such as tennis, can cause a cognitive overload [12].

Combining this knowledge, we can speculate that the activity trackers' shortcomings may not only be the irrelevance of the data as mentioned before, but also the information load of the feedback. Thus, we propose that the level of the information should be adjusted depending both on the context and the user. To give such tailored feedback, the devices should know its user as well as coaches know their players.

With this respect, it would be a novel approach to give feedback that can make the players be aware of the direction of their performance instead of laying out all the aspects. For example, if the players' performance is great, mediocre or poor, the feedback can signify "You are doing great", "You are doing ok" or "You can do better" respectively. We purposefully used the verb 'signify', because Ghajargar et al. suggests the feedback should be abstracted to make the users think with the information rather than through it, in order to initiate reflection [2]. Confirming the coaches, they state that reflection is crucial for self-behavior change, in this case self-performance change.

During the activity, performance feedback should be unobtrusive and passive.

Research on real-time sports feedback presents 'attention demand' as one of the biggest challenges on receiving information [7]. The studies on wearable technologies usually rely on alerting the users [11]. This approach is found to be distracting for the sportspeople [10]; yet, sportspeople are required to focus only on their own performance [4]. Coaches explicitly stressed that they avoid intervening, thus alerting their players, because they want their players concentrate solely on their performance. In some cases, they even avoid the players themselves, so the players would not understand they are performing poorly and start to panic. Therefore, we believe the level of intervention should also be adjusted depending on the context. The devices should be responsive to the changes in users' performance and wait for the right moment to give feedback.

Furthermore, the coaches' concerns on attention suggest that feedback should be designed unobtrusively. The alerting devices become obtrusive because they actively present information, without the user's initiation. For example, a smartwatch vibrates and presents visuals automatically, when the players achieve an activity goal. However, the coaches said the players come when they are ready for feedback. Thus, an alternative direction is to provide information passively [3]. With this approach, the users take the active role to explore the information when they require, while the device waits passively displaying persistent information. For example, the smartwatch's strap can change its outer texture when a goal is achieved. This way, the players can only sense the feedback when they intentionally touch the strap. We suggested a haptic modality, because as players will seek support, being able to continuously glance at the feedback would be extremely distracting. We believe designers should avoid using visual modalities like coaches avoid showing their expressions.

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CONCLUSION & FUTUREWORK

We interviewed six elite tennis coaches about their approaches for giving feedback to their players during games, to inspire future tennis activity trackers. As a result, we presented two design insights for giving useful real-time sports performance feedback: (1) During the activity, sports performance feedback should be in low-resolution, make the player be aware of their own performance and initiate reflection. (2) During the activity, sports performance feedback should be unobtrusive and passive. We believe these insights can point out novel design directions for wearable devices and activity trackers of sports that present similar challenges as tennis. Thus, we plan to design a feedback device that combines both approaches and compare it with conventional activity trackers.

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