

## An examination of the flow mechanisms and aspects of athletes in sports: an application of the flow engine framework

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*Purpose: The current study explores the experiences of flow reported by athletes in competitive sporting environments based on the flow engine framework of Šimleša et al. (2018). Methods: Participants comprised 18 athletes, – 11 soccer players and 7 golf players – competing in professional-level competitions. Participants watched videos of competitions within 1 week after a play that were edited to include individual plays, and vividly reported their experiences of flow, which were categorized into three constructs: conditions, states, and consequences, that correspond to the fundamental axis of the IPO (Inputs- Processes-Outputs) model in Šimleša et al. Results: The current study showed how the new components found through reflection on the environmental contexts of dynamic sports activities better explain the mechanisms by which athletes experience flow. These results expand our knowledge into sport-specific flow aspects originating from differences in-game environments. Conclusion: The current study offers new insights for understanding flow in sports based on new theoretical frameworks beyond traditional theories such as that of Csikszentmihalyi.*

KEY WORDS: Flow, IPO model, Cognitive process, Soccer, Golf.

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## **1. Introduction**

Csikszentmihalyi, after conducting in-depth interviews with high-achieving individuals in various fields such as sports, arts, and sciences, reported that they seek joy from their work itself and their competence in their work, and uniquely express their experience of being intrinsically motivated and completely immersed in an activity (Csikszentmihalyi, 1975, 2000). He named such subjective phenomenon “flow,” describing it as a state of deeply rewarding and optimal experience characterized by an intense focus on a specific activity to the point of becoming totally absorbed in it, and the exclusion of all other thoughts and emotions. When in flow, the individual can operate at full capacity with the genuine satisfaction in life as well as the activity on involved (Nakamura & Csikszentmihalyi, 2002). The phenomenon of flow has been extended into a variety of fields (online consumer: Lee & Wu, 2017; video game: Thin et al., 2011; music: Wrigley & Emmerson, 2013), and the flow experiences in sport have been considered to provide major criteria for evaluating the psychological states underlying optimal performance (Jackson & Marsh, 1996; Koehn, 2013; Pates et al., 2002; Pates & Maynard, 2000). Flow in sport is described as the state of “being in the zone,” as athletes say, and this expresses the state of absolute absorption in an activity, where the activity itself becomes synchronized as the goal, and satisfying in and of itself, even in challenging situations (Stamatelopoulou et al., 2018). These are especially important given evidence that flow states have frequently been associated with elevations in well-being (Haworth, 1993), self-concept (Jackson, Thomas, Marsh, & Smethurst, 2001), positive subjective experience (Csikszentmihalyi, 1975, 2002), and objective performance (Jackson & Roberts, 1992). Therefore, understanding how the flow state is experienced by athletes could yield important insights into how it may be experienced more often.

### **1.1 FLOW IN SPORT**

Sport offers rich opportunities to experience flow by posing both mental and physical challenges, so the state of flow in sport could be characterized by the dynamics of physical movement in a pressing situation of the competition with the opponent (Swann, 2016). Early flow research in the context of sport focused on experiences of flow and how such experiences affect optimal performance. Various pieces of qualitative empirical evidence suggest that athletes who have experienced flow are better satisfied with their

performance, and that athletes with high levels of achievements tend to experience flow more often (Jackson, 1992, 1995;). Later research focused on the experiences of flow, accumulating quantitative empirical evidence on the factors that induce or inhibit experiencing flow (Jackson et al., 1998; Stein et al., 1995), or developing a scale to evaluate the quality of flow experience (Jackson & Marsh, 1996). Such research has made possible the experimental verification of the relationship between athletes' states of flow and their tasks at hand, the results of which support the hypothesis that the degree of flow experience is a major factor for predicting athletes' performance (Pates & Maynard, 2000; Pates et al., 2002).

Recently, the literature of flow in sport is moving beyond the subjective understanding of flow phenomenon to consider more closely the mechanisms involved in the occurrence of flow. Flow can be facilitated by inner states (e.g., focus, excitement, motivation, confidence, thoughts, and emotions), external factors (e.g., environmental and situational conditions), and behaviors such as preparation in the activity one involved (Swann, 2016). Although there have been numerous conceptualizations in the field of flow research, the majority of existing research has been intensively focused on the Csikszentmihalyi's nine dimensions framework (clear goals, immediate feedback, challenge-skill balance, action-awareness merging, concentration on the task at hand, sense of control, loss of the self-consciousness, time transformation, autotelic experience) and sequential relationship of conditions, characteristics, and consequence (Csikszentmihalyi, 2000; Jackson & Csikszentmihalyi, 1999; Nakamura & Csikszentmihalyi, 2002). Flow conditions are prerequisites for flow to occur, including clear goals, immediate feedback, and challenge-skill balance. Flow characteristics describe what the individual experiences during flow, including action-awareness merging, concentration on the task at hand, sense of control, loss of self-consciousness, and time transformation. Lastly, flow consequence is replaced as an autotelic experience of being enjoyable and intrinsically rewarding.

Csikszentmihalyi's nine dimensions framework is adequate for simply explaining the conditions under which flow occurs and the characteristics of phenomena experienced during flow state. Accordingly, most understanding of how flow is experienced by athletes is based on his framework with the deductive analysis process in order to explore if this conceptualization applied in sport (Swann, Crust, & Vella, 2017, Swann et al., 2017). However, explanations for the complex mechanisms and aspects of flow are still lacking in sports domain (Jackman et al., 2017). This is due to inertia to reliance on deductive coding, which means findings could essentially be shoe-horned into the flow dimensions, without allowing for evolution or refinement of the the-

ory. This approach may prevent the emergence of new ideas and insights into explaining the complex mechanisms and aspects of flow in sport. Indeed, a systematic review by Swan, Keegan, Piggot, and Crust (2012) discovered that Csikszentmihalyi's dimension did not cover all the flow experiences reported by athletes (e.g., aware of effect; feel out of body, etc.). Also, new findings of Jackman et al. (2017) that discovered the sport-specific characteristic of flow (i.e., bodily sensations) indicated the need for a new framework to understand athletes' flow experience in sports. In the same vein, dimensional overlaps such as between conditions and characteristics of flow should be refined. This is due to the fact that as most flow research has focused on factors "associated" with the initiation of flow, researchers have been unable to suggest causal factors that contribute to this complex phenomenon (Swann, Crust, & Vella, 2017). Moreover, since sports involve dynamic and instant motive for flow, the existing model (i.e., Csikszentmihalyi's framework) has limitations in presenting an adequate explanation of the reciprocal process of flow in sport (Swann et al., 2015). Flow in sport is not just a state: It is a continuous process that is constantly recreated through ceaseless feedback and the balance between challenges and skills (Fong, Zaleski, & Leach, 2015). Accordingly, a novel framework needs to be examined to elaborate on the complex mechanisms and aspects of flow in sport.

## 1.2 FLOW ENGINE FRAMEWORK

In the sports domain, dynamic and complex interaction in the execution of motor skills and the cognitive process occurs during the flow state. This is the point at which a novel approach to flow in sports calls for. Šimleša and colleagues (2018) explained flow in terms of the link between contextual conditions and major cognitive functions, presenting a functional and dynamic mechanism for understanding the process of flow via the flow engine framework (i.e., Inputs-Processes-Outputs; IPO model). IPO model makes predictions about the conditions and processes that lead to an increased flow experience, which is similar to the conceptualization of Csikszentmihalyi aforementioned. However, this model more emphasized dynamic interactions between rearranged flow components and fundamental cognitive processes than the previous framework (i.e., Csikszentmihalyi's).

According to Šimleša et al., skill-challenge balance is a necessary input preceding flow, while clear proximal goals and immediate feedback in the process of pursuing a goal can be seen as the cognitive evidence of this phenomenon. Attention, which is a mediator of this cognitive mechanism,

is a prerequisite for the pleasure and sense of competency felt from the achievement of goals. The intrinsic motivation of a goal-seeking individual accelerates the activation of attention, and such processes make up the core processes of flow. Such processes are related to the specific outputs of flow. Subjective absorption in the process of seeking a goal is a state of extreme attention involvement; positive affect and task achievement, the results of expectant flow, are also considered dynamic media that interact with the intrinsic motivations of an individual. These results, by interacting with the prerequisite conditions of flow, initiate the positive cycle of flow state by achieving higher levels of skill-challenge balance.

The IPO model of Šimleša et al. (2018) provides an integrative explanation of the procedural mechanisms of flow, based on theories of cognitive psychology and the body of empirical knowledge in flow research. This framework focuses on the cognitive functionality of the individual components that make up the phenomenon of flow, providing logical explanations of the reciprocal process of flow in sport. Nevertheless, given the multidimensionality of core components of key processes in the flow engine framework, such as attention involvement and intrinsic motivations, this framework must be supplemented through empirical research specific to the contexts of that domain. Especially in sports competitions – where attentional cues change according to the aspects of play, continuously changing through interactions with situational variables – the conditions for the proposed flow engine framework can manifest differently. For instance, according to the IPO model, the intrinsic motivations that promote the core processes of flow are explained through internal dimensions that are focused on the goal itself due to the restrictions presented by the time constraints of information processing. However, the contextual characteristics of sports suggest that an organism's process of synchronization with external factors can also be related to the processes of flow. The environmental information perceived by an organism in the process of interacting with a goal is key evidence for goal-oriented attention (Bandura, 1988, 2004). The fact that executive attention can occasionally precede automatic attention according to skill-challenge balance is one of the fundamental assumptions of the transient hypofrontality hypothesis<sup>1</sup>, a part of the flow engine framework's assumption (Šimleša et al., 2018).

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<sup>1</sup> On this assumption, the flow experience is defined as “state of hypofrontality with the notable exception of executive attention, which enables the one-pointedness of mind by selectively disengaging other higher cognitive abilities of the prefrontal cortex.” In order to maintain the flow, however, hypofrontality is occasionally interrupted by an executive intervention that aims to restore the implicit, hypofrontal state.

Also, recent studies on the neurocognitive model of flow advocate that attentional execution could be variant during the flow state based on the transient hypofrontality hypothesis (Gold & Ciorciari, 2021).

Athletes, who recognize the dynamic changes in their situation presented by the ever-changing contexts, opponent, or environment, must maintain their flow or initiate a new flow as they react to such variables (Fong et al., 2015; Swann, 2016). Therefore, to understand flow in sport adequately, traditional theories of flow that have been applied in general contexts (i.e. Csikszentmihalyi's model) must be integrated with new theoretical frameworks that fit the characteristics of the sports environment, which then should be used in research applying scientific methodologies. The flow engine framework (IPO model) is appropriate for this, as it can serve as a theoretical foundation for complex forms of flow borne by intricate interactions—similar to that of flow in sport—and their detailed understanding.

### 1.3 THE PRESENT STUDY

Research on flow in sports domain, unlike that on flow in general, has focused on the optimal performance of athletes and the phenomenon of flow experience itself. However, if the specific mechanisms of athletes' flow could be identified and differences in the patterns of flow could be examined in the context of different sporting events, this might provide a foundation for research to reduce the opacity of concepts of flow in sport. Therefore, the current study aimed to determine the flow aspects of athletes in two dissimilar sports with differing characteristics: soccer and golf. Their experiences would be examined qualitatively to collect evidence that will then be compared and examined within the IPO model of the flow engine framework.

Traditional research methods for studying flow mainly utilized in-depth interviews, experience sampling methods (ESM; Csikszentmihalyi & Hunter, 2014), and questionnaires (The Flow Questionnaire and Flow Scale; Delle Fave & Massimini, 1988, Activity Flow State Scale; Payne et al., 2011, etc.). ESM, which is capable of measuring the degree of flow instantaneously, cannot be used for athletes who are actively participating in an event; questionnaires can be useful for large numbers of participants, but those are limited in discovering new aspects and dimensions of flow (Swann et al., 2019). Therefore, in order to investigate mechanisms and aspects of athletes' flow, the research methods will be centered around the traditional in-depth interview, which will then be supplemented with new methods. For investigating the experience of athletes' flow, recalling specific moments of a game is insuf-

ficient: An apparatus is needed capable of replaying continuous experiential records of an event or match (Swann, Crust, & Vella, 2017). Accordingly, the current study conducted in-depth interviews with

## 2.1 APPROACH

All researchers conduct their own study based on individual-specific philosophical worldviews. The researcher's philosophical worldview is a 'bundle of basic beliefs that lead behavior' (Guba, 1990), and the overall methodology of the study is determined by athletes as they watched video recordings of their sporting matches or events in their entirety.

Overall, the goal of the current study is to apply new methods to research of flow in sport in order to compare mechanisms and aspects of athletes' flow that appear differently in other sports through a theoretical application of the flow engine framework.

## 2. Method

### 2.1 PARTICIPANTS

the researcher's individual perspective. Accordingly, the researcher's philosophical perspective affects the entire study design, such as setting up the research problem and establishing and choosing detailed methodological issues. Although researchers' philosophical worldviews are often hidden within the study (Slife & Williams, 1995), it is importantly recommended to clarify the researcher's perspective because they have a great influence on conducting the study (Creswell, 2008).

This study was conducted based on a pragmatic worldview. The pragmatic approach focuses on the utilization of the value of knowledge and aims to produce useful knowledge (Friedrichs & Kratochwil, 2009). In addition, rather than focusing on research methods, it emphasizes research questions and is interested in solving and applying them (Patton, 1990). For this reason, the pragmatic approach is not limited to a specific philosophical system and reality, but utilizes all approaches (qualitative/quantitative) to understand research questions (Rossman & Wilson, 1985), that is, rather than relying on one methodology, researchers can freely choose study methods and procedures corresponding to them. In addition, the pragmatic approach values the execution of practical research that can best deal with research questions and selects contents and methods based on what they want from

the study results. In this study, the mechanism and aspect of athletes' flow are treated as major research questions. Athletes' flow is a specific phenomenon experienced in a dynamic sport context, and there is a need for a way to derive in-depth and rich information about the flow experience occurring in the game situation. Therefore, in order to solve these research questions, we examined the flow pattern and mechanism of athletes through semi-structured interviews and compared it to the flow engine framework.

## 2.2 PARTICIPANTS

Participants were recruited through a criterion-based selection method (Miles & Huberman, 1994). In criterion-based selection, several selection criteria ([a] more than five years of career; [b] professional-level; [c] experience of flow in sports) were determined according to the purposes of research. Accordingly, professional-level athletes who are judged to have accumulated a large part of their experience and knowledge in the sporting career were set as the participants of the interview. The current study, in consideration of the different characteristics of the two sports (open vs. closed: skill / team- vs. individual: game), recruited professional soccer players in K1 [division-1], K2 [division-2], and WK [Women] leagues, with professional golf players in KPGA [men] and KLPGA [women]. As shown in (Table 1), 11 soccer players and 7 golfers were recruited (10 male, 8 female), ranging in age from 21 to 34 years ( $M = 26.5$  years), and with career lengths ranging from 5 to 17 years for soccer players ( $M = 13.8$  years), and 10 to 21 years for golfers ( $M = 14.4$ ). All 18 participants were asked to participated in the interview through an agent hired by the researcher and gave verbal consent for participation to the researcher.

TABLE I  
*Demographics of Participants*

No.	Sex	Age	Career years	Competition level
B	M	34	21	KPGA
D	M	33	20	KPGA
F	F	22	10	KLPGA
G	F	28	14	KLPGA
H	F	25	15	KLPGA
I	F	27	17	KLPGA

(Continued) Table I



(Continued) Table I

No.	Sex	Age	Career years	Competition level
J	F	30	18	KLPGA
K	M	27	17	K1 League
L	M	27	15	K2 League
M	M	27	17	K1 League
N	M	27	16	K1 League
O	M	25	12	K1 League
P	M	27	15	K1 League
Q	M	27	17	K1 League
R	M	27	16	K1 League
S	F	21	5	WK League
T	F	21	13	WK League
U	F	22	9	WK League

Note: K1 [division-1], K2 [division-2], and WK [Women] soccer leagues; KPGA (Korea Professional Golfers' Association) [male] and KLPGA (Korea Ladies Professional Golf Association) [female]

### 2.3 DATA COLLECTION AND PROCEDURE

In accordance with the flow engine framework, a semi-structured interview guide was established for determining the flow experiences of participants. The content of interview questions is as follows (Table II).

TABLE II  
*Flow Framework Questions*

Components	No.	Questions
General perceptions	1	Can you explain your knowledge and experiences of flow?
	2	Generally speaking, how do you feel while experiencing flow in sport?
	3	(Edited video footage) From the match you are watching today, what are the things you remember?
Inputs	4	In what circumstance/situation do you usually experience flow in the game?
	5	Why do you think you experienced flow in this moment (video footage)?
	6	What are the elements that hinder or challenge your experiences of flow during the game?

(Continued) Table II

(Continued) Table II

Components	No.	Questions
Core processes	7	Can you explain how you feel in the moment flow in the game?
	8	During flow state, how was your focus of attention?
	9	During flow state, what were you trying to accomplish?
Outputs	10	When you were experiencing flow during the game, did you feel that in the moment?
	11	When you were experiencing flow during the game, what were its good aspects?
	12	In reality, what did you accomplish in the match through flow experience?
Additional ideas	13	Do you have anything to add to the things we discussed today?

Also, in order to ask about the flow experience of the participants during the game, the video materials were used. This material was made by the research team, shooting the video of the interviewee athletes' plays with observing their regular games on the field. In advance, with the consent of the interviewee, individual plays were tracked and recorded, which were then pasted to be played simultaneously side-by-side with media coverage of the same match (Figure 1). The number of collected videos was three to five, and all of them were about the game in which they were playing the full game a month before the interview day. During the interview, the researcher explained to participants the definition of flow, and the participants chose the most recallable competition among the prepared match videos. So, the



Note: Left is the media footage, right is the individual athlete's footage filmed by the researchers.

Fig. 1. - Video footage edited for interview purposes.

participants were asked to recall the experience of the game they chose and state how the flow's Input, Core Process, and Output appeared.

During the interviews, the interviewee and researcher watched the edited video in chronological order, recalling the overall aspects of the game. And Part 2, Once the review of the match was completed, the second part of the interview lasted for about 1 to 2 hours. Interviews were conducted following the semi-structured interview guide, with probing according to the progress of the interview or the reactions of the interviewees. With the participants' consent, all interview content was recorded digitally and then transcribed by the researchers. Interviews were conducted from January 2020 to June 2020, and the length of each interview was 150 minutes to 180 minutes for each participant. All individual interviews were conducted by the lead author (SK). The semi-structured interview consisted of two parts: Part 1.

## 2.4 DATA ANALYSIS

As the current study was based on the theoretical background of the flow engine framework, the data analysis utilized the three dimensions of the IPO. While the framework of this model made it easier to code and cross-examine the data, the researchers did not rule out the possibility of discovering novel dimensions or relationships (Creswell & Poth, 2016). Accordingly, the data analysis was conducted in both the deductive phase and inductive phase depending on the purpose of the study.

In order to discover novel categories and definitions, Elo & Kyngäs' (2008) model was used for content analysis: The deductive content analysis is used when analyzed based on prior knowledge, while the inductive approach is recommended if the prior knowledge of the phenomenon is insufficient or the knowledge is fragmented. Three-stage of Elo & Kyngäs' model was as follows: In the preparation phase, the overall context of the data was identified by judging the appropriate analysis unit and process according to the research question. During the organizing phase, data can be coded based on existing theories, but an unconstrained matrix can be utilized depending on the purpose of the study. In this study, it was coded based on an IPO model according to a deductive approach, and there were new categories that were not classified into the existing matrix, so it was attempted to analyze them according to an inductive approach using an unconstrained matrix. The reporting is a stage of expressing the research results so that others can understand them. So, the novel result comparable with the referent model was appraised with the supporting evidence to the existing model, altogether.

To prevent bias, data analysis was based on member check and peer debriefing methods. First, researchers read each transcript in detail, proceeding to write initial interpretations. In this process, the researchers focused more on the understanding of the participants' intent and meaning, rather than on the coding of data. After thoroughly familiarizing themselves with the data, researchers shared their initial interpretations with each participant, requesting clarification or additional information on unclear or contradictory points. Through this process, researchers were able to develop a comprehensive understanding of the experiences of each of the participants in the study. Also, misinterpreted parts were corrected and supplemented through repeated discussions and exchange of opinions with experts with professional knowledge and experience in the relevant major.

Content analysis through cross-examination aimed to identify novel content and relationships related to the composition of the model, which was then compared with the original IPO model. All researchers shared their interpretations of the data; the process was coordinated by the lead author (SK), who is familiar with the processes of conducting qualitative research.

### **3. Results**

Participants reported the conditions, states, and consequences of their experience of flow in competitive sporting environments, which were then used to compose detailed mechanisms of the IPO model hypothesized by the flow engine framework (Figure 2). Such results are indicative of mechanisms of athletes' flow experiences that appear across different types of sports, which adds detail to the existing IPO model from the context of sporting events. Key differences from the original model are as follows: (I)input: Core components have been categorized into more detailed subdivisions, (P)rocess: The role of external motivation was added to the relationship between attention and motivation; and (O)utput: The pathway and feedback loop has been revised for intrinsic and external motivations. Solid outlining indicates parts that were retained from the original model; dotted outlining indicates novel components or relationships. Results are presented under each component of the model.

#### **3.1 INPUT**

The input process, a prerequisite condition for flow, stands for the logical requirements for flow, in much the same way that an engine needs fuel to

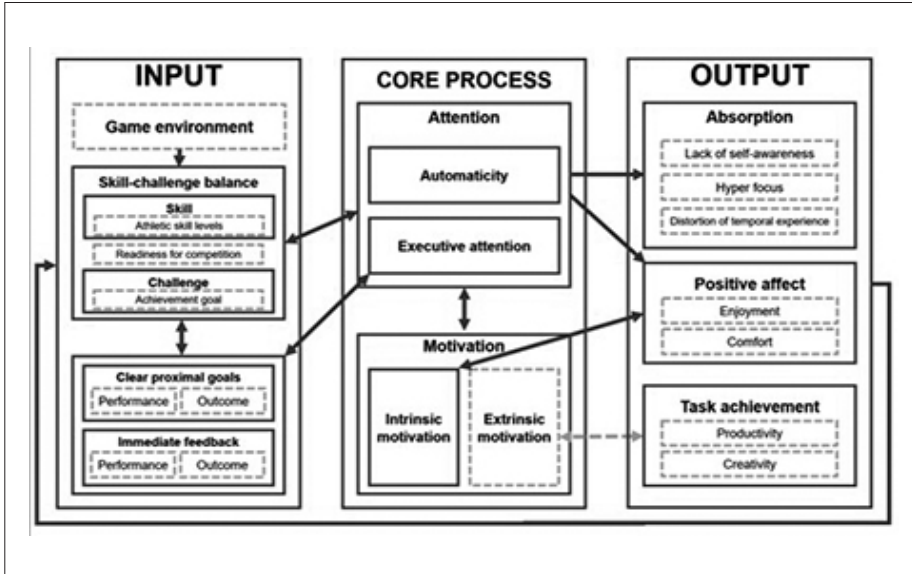


Fig. 2. - Athletes' flow engine framework.

start. It includes newly identified sports environment factors, skill-challenge balance controlled by preparation for competition, and the relationship between clear proximal goals – consisting of performance and outcome – and immediate *Feedback*.

### 3.1.1 Game Environment

For athletes, the aspects of a game change constantly from one moment to the next; such changes affect not only the play of an athlete, but also the process of experiencing flow. Depending on how the athlete perceives the ever-changing situation and handle, the degree of flow experienced by the athlete changes significantly. For instance, weather conditions, ground conditions, presence of spectators or gallery, and opponents have been categorized as components of a game environment. These components of the game environment play a role in determining the level of skills and difficulty of the challenges the athletes must face. Therefore, the game environment meets the logical requirements for flow by influencing

the skill-challenge balance that is prerequisites for flow in the input stage, just like fueling the engine.

*Weather condition.* Since golf and soccer are outdoor sports, changes in the weather and an athlete's perception of such changes affect the athlete's plays. Since athletes adjust their playstyle or situational reactions according to given weather conditions, this can be categorized as part of the psychological environment. For athletes, weather is a variable that needs to be controlled: For some, it can be an element that hinders flow experience in sports, but for others, it can promote their experiencing of flow.

*"When there's strong winds, it's difficult to replicate my usual flight path or driving distance (of the ball); if I had to choose, rain is a bit better than winds. In the presence of winds, I have multiple things I need to focus on, which subtracts from my focus on the course or the shot."*

Golfer D

*"For daytime games, the sunlight can disturb you when securing the field of vision for the ball; predicting can be very difficult when there's wind involved on top of all this. Also, on hot and humid days, you can get fatigued quickly from running and using your stamina, so you need to pace yourself accordingly. Since soccer is an outdoor sport, your plays cannot help but be affected by such (weather) factors."*

Soccer player K

*Ground condition.* Ground conditions, an environmental circumstance of the game, and other aspects of a game can change: Naturally, an athlete's reaction to said conditions will change accordingly. Athletes, thanks to accumulated experience of play, possess the techniques necessary to execute plays appropriate for different ground conditions; however, since every game has different ground conditions, athletes are constantly faced with new challenges. In the process of addressing these challenges, athletes' degree flow experience is also affected.

*"For this game, my tee off was very early in the morning. I was tired physically since it was very early, but the ground conditions were good since the teeing ground was not damaged at all. However, on long roughs, it was difficult to control the ball, and also hard to send the ball as far as I wanted to; it was stressful. Since I was on my nerves trying to avoid the rough, I made a lot of mistakes, and my immersion in the game got worse."*

Golfer J

*"On days when the grass is watered too much, the ball speed gets extremely fast, and it is also harder to control your own movement. In such cases, you need to prepare yourself to react immediately when your team passes the ball, and be proactive with your movements by predicting the opponents' actions. As such plays get repeated over and over, I feel like I end up focusing more on my plays. Also, for games like this one where the grass field is natural and longer in length, the ball doesn't travel as far as you would expect it to than*

*you would expect it to; every pass and kick need my attention. These things also affect my process of controlling where to focus my attention"*

Soccer player J

*Spectator.* In golf, it would be quite unusual if the gallery were to cheer loudly for the player they like; in soccer, the spectators yell at the top of their lungs, cheering for their players and booing the opponents. The spectators of different sports have different ways of showing support for their athletes. Since the athletes know that the spectators are rooting for them, both the presence and the number of spectators are factors that make athletes experience deeper flow during the game.

*"The larger the gallery, the more immersed in the game I become. If there's no gallery, I get distracted easily and feel it's difficult to focus."*

Golfer G

*"When I am standing in a large stadium amid all the noise and the loud voices of the spectators, I can feel on my skin the fact that I am a professional athlete participating in a professional match, and that's when I better experience flow."*

Soccer player P

*Competition opponent.* For athletes in competitive sports, the most apparent confrontation they face is the competition with their opponents. The opponents' competitiveness decides the difficulty of the challenges to be faced by an athlete, and therefore it could be said that the scores or performance of an athlete may be evaluated through their interactions with their opponents.

*"For me, the athletes placed in the same group matter a lot. I get affected by the group I am placed in, by who I will be playing against. I have no choice but to see their results alongside my own, and compare their performance with my own."*

Golfer I

*"Depending on the playstyle of the opponent, whether it's easier or harder to play against, I decide what I need to focus on. I can focus better on my own plays when I am up against an opponent that I have ample experience with, and one who I can address appropriately."*

Soccer player O

### 3.1.2 Skill-Challenge Balance

Using the data to determine the components that belong in the subcategories of skill-challenge balance, athletes' level of technique was categorized

in the skill category, and the achievement goal of athletes was categorized in the challenge category. Furthermore, in the context of sports competitions, the skill-challenge balance was seen to have a dynamic relationship with athletes' readiness to competition, where the balance was moderated by readiness perceived by the athletes themselves. Interview content related to each component follows:

*Athletic skill levels.* The athletic skill levels of an athlete determine the level of competition the athlete faces. Since the participants belonged to professional-level divisions, they were thought to have sufficient skill to face the challenges that they would encounter. Although athletic skill levels stay relatively stable, athletes can improve their skill levels through constant effort devoted to training and practice. Increased skill levels allow an athlete to compete in a higher-level division, and such balances are the prerequisite of maintaining flow.

*"I must have the skill levels that allow me to compete at the level I am currently competing at. If I do not have enough skill to be competing at the level I am competing at, it is difficult to focus on the situations of the game, and vice versa."*

Golfer B

*"The fact that you are participating in a match means that you have skill levels meriting that level of competition, so this condition does not change. However, if you can increase your skill levels, you can join more competitive teams or higher-level divisions, which will lead to flow experiences of even better quality."*

Soccer player N

*Readiness for competition.* For athletes, readiness for competition is a mediator factor that control the balance between skill and challenge. When the next game is imminent, while the skill levels are more or less set at a certain point, the execution of skills—in the dynamic interaction with challenges presented during a game—can be determined by the physical and psychological readiness of the athlete. Readiness for competition is considered to be a key variable of flow that allows athletes to execute their skills to the fullest in a competitive environment.

*"First and foremost, you must balance your physical conditions. For instance, having physical sensations different from usual can affect the execution of skills I have prepared through my training. Physical sensations are linked to psychological states; if you cannot resolve the uneasiness somehow, it is very difficult to make the shot you want to make. There is a need to prepare my body and mind sufficiently in the face of a game."*

Golfer B



*"Every week we have a match with other teams in the same division, but the fact is that you cannot play with the exact same conditions every single time. We try to make that happen, but it can be difficult sometimes. My athletic performance is inevitably affected by my physical or psychological conditions."*

*Soccer player L*

*Achievement goal.* For athletes in competitive sports, the most direct challenge they face is achieving their set goal. Their opponents or their achievement goal determine the difficulty of challenges an athlete faces, which is controlled by the interaction with an athlete's skill levels. In the end, competition in sports is either a comparison of an athlete's skill levels with those of other athletes, or with the athlete's achievement goals.

*"I play within the boundaries of my usual records. A challenge too difficult leads to fear, and a challenge too easy leads to too much relaxation."*

*Golfer I*

*"When the opposing team's skill level is close to that of our own, the game is more dynamic and interesting to watch. When I get the feeling that we will win if I can commit just a bit more, I get completely immersed in the game, free from other distractions."*

*Soccer player R*

### 3.1.3 Clear proximal goals and immediate feedback

After analyzing the data to determine the components under the category of skill-challenge balance, performance and outcome goals were categorized in the clear proximal goals category, and performance and outcome feedback were categorized in the immediate feedback category. Interview content related to each component follows:

*Performance goals.* Performance goals are focused on exhibiting the athletes' skills, a type of target that is directly related to the task or goal. Athletes have tendency to try and perform to their maximum in competitive games, which sometimes becomes motivation to continue competing regardless of the outcome.

*"Just one thing, I think of just one thing when I take the swing and hit the ball. Just one action, just one thought of 'This is the shot I want to take.' That is all I think of."*

*Golfer D*

*"The objective is that we must not let the opponents score a goal, and if you look toward the defense players on your team, of course you want to win the game without letting the*

*opponents take a single goal, you know. When I think of those things, I focus better, and get better immersed in the game."*

*Soccer player S*

Outcome goals. Outcome goals project the desired results of one's competitive performance. Performance can be evaluated from various outcome goals: Athletes can focus much better on the game in order to achieve their outcome goals.

*"Overall, I think about how many points I will need in order to win the series, and I set that number as the goal and try to achieve that number. Then, naturally, I can perceive what I need to do, and recognize that clearly."*

*Golfer G*

*"In any case, I compete in order to win the game. There is no clearer goal than victory. The clearer the goal, the better you can commit to the competition."*

*Soccer player L*

Performance feedback. In the midst of ongoing games, athletes can constantly check their performance, and such feedback can constitute a solid standard for adjusting their competitive performance. Performance feedback is granted immediately and clearly to the athlete; this is truer for athletes who focus on their own training.

*"The rhythms I was aspiring for, of the body and the swing, were staying constant, and I was getting clear and accurate feedback. I can focus on my own plays and not think of anything else. When I can't do that, I need to think of many other things, and start to lose my concentration."*

*Golfer B*

*"The situation I trained for in my practice sessions appeared in an actual match; in these situations, I had much better experiences of flow. I can concentrate much better on my own plays."*

*Soccer player M*

*Outcome feedback.* The performance outcomes of individuals and/or teams are a straightforward measure of the achievement of goals set by oneself. Since the plays of individuals and/or teams are evaluated by the outcomes, athletes can get an idea of what they need to do for the next play, or the upcoming match.

*"I was thinking that the Fourth Hole would be the most difficult; after getting a birdie at that hole, my confidence was almost maxed out."*

*Golfer I*

*"On this day, I scored 4 goals in the first half of the game; I was experiencing good flow, and was comfortable psychologically."*

*Soccer player Q*

### 3.2 CORE PROCESS

The core processes of flow are a cognitive mechanism necessary for controlling the input and shaping it into outcomes, similar to an engine that converts fuel into kinetic energy. This includes attention and motivation for goals.

#### 3.2.1 Attention

Using the interview data to determine athletes' mechanisms of attention, as proposed by Šimleša et al. (2018), the period of implicitly sustained focus on the goal—also known as automaticity—and the executive attention for processing explicit information were identified as their components. Interview content related to each component follows:

*Automaticity.* While experiencing flow, athletes felt that everything was being carried out automatically. In that moment, the athlete is, of course, extremely focused on the game and the goals at hand, but there is nothing being done in a conscious manner. The entirety of the athlete's consciousness is focused on the goal implicitly, and automatically.

*"Rather than focusing on each and every moment, one by one during the shot, there are times when I take the shot with a singular focus on the moment. There are no worries or hesitations, and everything is carried out automatically."*

*Golfer B*

*"Since it's the play I have been doing all the time, I can also do it automatically during the game. How do I do this, what will the opponent do... if I think of all these other things, it's actually more difficult to focus on my own plays."*

*Soccer player T*

*Executive attention.* Because flow is a dynamic process, automatic attention can become unstable from time to time. When there exists an imbalance between the skill level of an athlete and the difficulty of a challenge, a cognitive process is required to resolve or address the gap of the imbalance. Athletes put in the cognitive effort to readjust their target or execute the

maximum potential of their skill levels. It is an active exploration/processing of environmental information for experiencing flow.

*“Games are long. Every hole has different scenes play out on it, and you need to think of the whole course in the context of each hole. When those individual moments come together, I feel that flow can perhaps be experienced from the bigger picture.”*

Golfer I

*“When we are actively attacking in the opponent’s half of the field, you never know when they will take the counteroffensive; in order to recognize such situations, I focus more and devote more of my attention.”*

Soccer player S

### 3.2.2 Motivation

Two processes of attention can result from different kinds of motivations for games. Intrinsic motivation, centered around the goal itself, is the source of automaticity that makes one focus on goal-related information; extrinsic motivations, focused on processing various information and overcoming challenges in competitive environments, are connected to executive attention. Similar to clear proximal goals as components of input, these motivations are considered key components that make it possible for athletes to experience flow. Interview content related to each component follows:

*Intrinsic motivation.* Intrinsic motivation reflects the directionality toward experiencing flow. In other words, the will to experience flow can be the explanation for intrinsic motivation. Intrinsically motivated athletes tend to focus harder on their goals, and such processes of attention are carried out automatically.

*“I do my best, since I want to do well in this game. Regardless of the seeding round results, I want to do well on each and every shot. That is why I can focus better on every hole, and every shot.”*

Golfer I

*“I want to feel that moment of concentration, that is how I want to achieve in the game.”*

Soccer player N

*Extrinsic motivation.* From accomplishing given goals to being supported by the spectators, extrinsic awards can be a major factor for an athlete

to commit to a game. Information related to extrinsic goals is processed by executive attention: When such processes are resolved well, athletes can approach closer to achieving flow that makes them better focused on their goals.

*"I was thinking that I need to be above the cut line, which gave me better motivation. Sometimes such thoughts make it difficult to focus on the game, but with enough time, these thoughts give you motivation that actually helps you focus better on the game, and focus just on the game."*

Golfer F

*"When the club awards bonuses for important games, I certainly feel better immersed in the game."*

Soccer player K

### 3.3 OUTPUT

Finally, the outputs of flow are psychological phenomena experienced through cognitive mechanisms that include absorption, positive affect, and task achievements. Such optimal experiences not only interact with core processes of flow, but also affect components of the inputs that serve as the prerequisite conditions of flow. The promotion or hindrance of such cycles are determined by the quality of outputs.

#### 3.3.1 Absorption

Absorption, one of the major psychological results of flow, is closely related to the mechanism of attention in the core processes of flow. Using the data to explore the phenomenon of absorption among athletes, it was determined that there were multiple kinds of subjective experiences, such as lack of self-awareness, hyper focus, and distortion of temporal experience. Interview content related to each component are as follows:

*Lack of self-awareness.* Since all psychological resources are being utilized to accomplish their goal, athletes do not have surplus resources to be self-conscious. Such experiences are difficult to perceive in the very moment, but they are similar to the experiences of flow reported by athletes.

*"When I'm experiencing flow, I feel like my caddy and I are the only people on the course. I don't see other players' plays, or anything whatsoever; I don't remember the scores either."*

Golfer I

*“When I was experiencing flow, I did not have any thoughts. I just see the ball and the other players around me; that’s how I felt. I did not care too much about where I was or what I was doing.”*

*Soccer player P*

*Hyper focus.* Likewise, because cognitive attention is focused on processing the goal and goal-related information, a high degree of focus, or hyper focus, can be achieved during a competitive game environment. This state of hyper focus can be sustained for certain periods of time, and can change in intensity with the changing aspects of a game.

*“I have various thoughts which become simplified, and end up focusing very hard on that single thought.”*

*Golfer B*

*“Later, you know, situations like a throw-in or when the ball’s stopped. Those are the times when I see more things around myself. Since I was experiencing flow, only after I have gotten out of it can I see the things around myself better; after I’ve come out of hyper focus, I can see the spectators, or hear their cheers.”*

*Soccer player N*

*Distortion of temporal experience.* Temporary distortions in experiences are closely related to the flow of time. When experiencing flow, all one’s attention is focused on achieving the goal, making it difficult to perceive anything else: This is why it is difficult for athletes to have a normal perception of time during a game. If athletes were aware of their state of flow, even by a small increment, they would realize just how fast time has been passing while they were experiencing flow.

*“I have no thoughts in the moment. In that moment, there’s no distractions, and I cannot think of anything other than the situation I’m in. Then I think ‘Ah, this is what I did’ as I finish the hole.”*

*Golfer F*

*“It feels like time is flying like an arrow; in the moment where the goal was scored, I could see the ball flying in slow motion.”*

*Soccer player M*

### 3.3.2 Positive affect

As for the components of positive affect – one of the result of flow – identified in the data, comfort was a novel factor that was added to the ex-

isting factor of enjoyment. Such emotional experiences are among the major reasons for seeking experiences of flow—an autotelic experience—which also relate to intrinsic motivations for achieving one's goals. Interview content related to the components follows:

*Enjoyment.* Experiencing flow is perceived as an enjoyable feeling. Although such feelings may be difficult to perceive in the moment, having the experience of these positive feelings can be one of the major reasons for attempting to experience flow again.

*"The fact that I am experiencing flow is evidence that I am playing well, so it feels good. I want to play like this again."*

*Golfer D*

*"I don't know it at the moment I'm experiencing flow, but afterwards, I feel good. I am satisfied with my own plays, and the experience of being able to play like that is enjoyable in and of itself."*

*Soccer player U*

*Comfort.* Flow occurs in moments of extreme competition, where all skills are executed automatically and the sense of self-awareness is dispersed to the point of nonexistence. Such experiences of flow make athletes forget their physical or psychological fatigue, which makes them feel comfortable while they are in the middle of flow. Likewise, it stimulates the motivation to prevail in difficult and challenging competition.

*"I am not anxious or restless; I just carry out my own plays with a comfortable feeling."*

*Golfer B*

*"Experiencing flow makes me feel comfortable in competitive game situations. Even though I know that I just executed a rough and difficult play, I feel as if I just finished experiencing a moment of peace."*

*Soccer player R*

### 3.3.3 Task achievements

Flow is considered a strong predictor variable for task achievement associated with playing in competitive games. Task achievement – as a result of flow – is composed of productivity and creativity. Such achievements further stimulate an athlete's motivation to achieve his or her goals. Interview content related to each component follows:

*Productivity.* Productivity, or the objective performance of an athlete, can be explained as the achievement rate of goals set by the athletes themselves. Such results push the athletes to replenish their motivation to attain higher degrees of achievements.

*“When I experience flow, there’s a big difference from when I’m not experiencing flow. It shows in the differences in scores. So, I try again and again to experience flow as much as possible.”*

Golfer H

*“I feel as if I won more games when I better experienced flow; I also remember dribbling and passing successfully for the majority of the time.”*

Soccer player M

*Creativity.* Creativity, or the subjective performance of an athlete, stands for an athlete’s productivity as perceived by themselves. This can be a major criterion for excellence that exceeds the athlete’s objective performance.

*“Thinking back on my own plays from when I was experiencing flow, I was capable of doing things that I never could do in practice sessions. They were shots that I would have tremendous difficulty doing if I were to try and replicate them.”*

Golfer F

*“My performance in flow is great, but more than that, there are things that I just execute without conscious intent. I have a feeling that my teammate will be in that space, and when I connect to that space, it really gets executed very successfully. Those things just happen naturally, almost as if they are ordinary, while I’m experiencing flow.”*

Soccer Player N

### 3.4. DIFFERENCES IN FLOW ASPECT BY SPORT: GOLF VS. SOCCER

This study recruited athletes in two sports with different characteristics (open vs. closed: skill / team- vs. individual: game): soccer and golf. Athletes reported different aspects of experiencing flow according to the specific characteristics of their sport, which also indicated significant differences in the framework of this research. Such differences were apparent in the feedback process of flow and were also seen in game environments, which is one of the key conditions of flow (Figure 3).



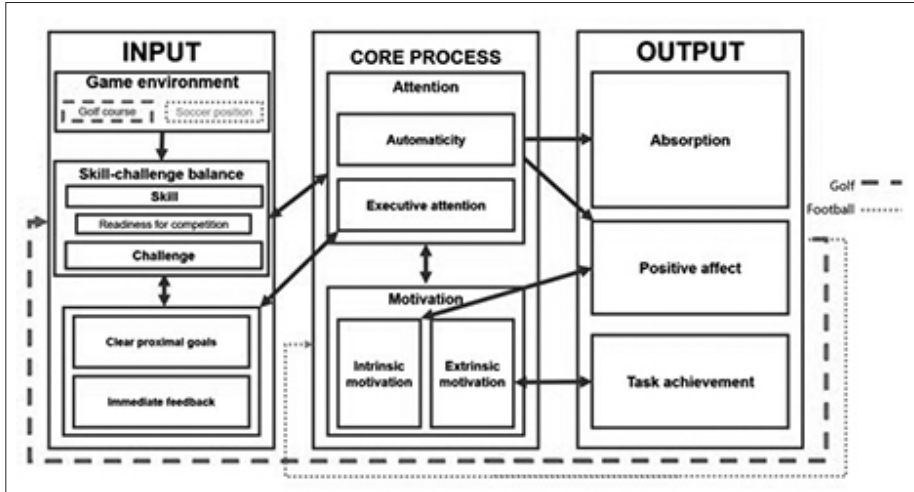


Fig. 3. - Differences in flow between golf and soccer.

### 3.4.1 Differences in the feedback loop

In the IPO model proposed by Šimleša et al (2018), goal achievement through flow provides the newest information on skills and challenges in the input process, which allows athletes to revise their goals. Such processes reinvigorate the motivation to engage goals, causing executive attention – one of the core processes – to create a virtuous cycle that leads to outcomes of flow. Likewise, athletes’ flow mechanisms enter a virtuous cycle when the output of flow starts adjusting the input factors of flow experience. However, aspects of the game or changes in the surrounding environment can show different aspects in distinct sports. Šimleša et al. (2018) mentioned that the feedback loop that promotes the core processes of flow can appear differently depending on the characteristics of the task at hand.

*Golfers.* In golf, a game is not executed in a single breath; since athletes need to move a long distance after a shot before they can make the next shot, there are large temporal gaps between one shot and the next. For golfers, then, every shot creates a new process of flow: For each and every hole, the achievement of goals through flow seem to promote even higher levels of flow as the golfers are capable of attaining even higher levels of skill-challenge balance.

*“Since it was a difficult course, I was nervous and got immersed in every hole; in the end, it was really helpful. If you were to get confidence from the previous hole, you can make good*

*shots in follow-up plays; regardless, since every hole is a new game situation, you need to invest the effort to reestablish your focus."*

*Golfer I*

*"For every new hole, I prepare a new mindset. It's a new game, so I try my best not to get affected by the results of my previous shots or holes."*

*Golfer H*

*Soccer players.* Unlike golf, the current of the game can be very important. On top of that, each team interacts with the other, which puts athletes head to head in unpredictable and variable situations. Therefore, it is important for soccer players to perceive the shifting environment and manage the situation appropriately, if they are to maintain their experience of flow. The flow mechanisms of soccer players after achieving goals in the output process return to the core processes of flow to activate attention involvement, rather than returning to the input phase.

*"When we are in the mid-to-late game phase, the opponents know a fair deal about the game, and we have to keep making plays; at times, in the last 10 to 15 minutes we are losing, or we need to preserve and protect our lead. When we're winning, we need to protect the lead; when we're losing, we need to score goals. In short, we need to use lots and lots of energy. There's a current of games. Times when flow is sustained continuously..."*

*Soccer player M*

### 3.4.2 Differences in the game environments

*Golfers.* Golf, due to its characteristics, has constantly changing conditions for every hole and course. Different holes require different numbers of shots to make par; even for identical pars, there can be countless variations in the obstacles and terrain. Each golfer has preferences for different holes and courses. Each hole and course has objective influences on the shots of a golfer, but they also exert significant influence over the psychological processes of golfers.

Since every golfer has different physical endurance and skills, different golfers plan out their plays differently although they are all playing on the same course with identical conditions. While golfers with good driver shot skills prefer long-range games with par 4 or higher, others can be more capable on fairway courses that call for more iron shots. Such playing characteristics of each golfer affect their course management, and the changes in game aspects can act as contextual characteristics that control the golfers' experiences of flow.

*"Golf courses I prefer. I really like golf courses in the OO region. Whenever I'm there, everything works just the way I want it to; since I can feel that, I can experience flow easily when I'm there. It must be because most of the holes are made of courses I like. The hole location on the green was very difficult to understand – maybe because it was the last day of the competition – but it did not affect my plays too much; I guess that was because I've practiced a good deal."*

Golfer B

*"Course management, in the end, is under the influence of psychological effects. My confidence in my shots or my worries about them. Of course, they will affect how I will attempt the course. This is especially true for courses that have difficult hazards and long roughs, since I cannot help but recognize the dangers and risks. I guess that's the characteristic of a course: The fact that it makes you think about such things. Your thoughts or plans for your shot change according to the course."*

Golfer D

*Soccer players.* For soccer, players' roles are classified as goalkeepers, defenders, midfielders, and Forwards: Each role has different parts to play, which means that athletes in each role have different sets of required skills and situations to respond to. In the interview data, there were numerous mentions of the different roles of soccer. For soccer players, their position was an environmental factor that acted as an antecedent for their flow process, which in turn affected their overall experience of flow.

Forwards are tasked with the critical role of making the scores for the team; that is their ultimate goal. Roles specific to the striker position were promoting the experience of flow when strikers were on the brink of scoring or when they needed to protect the ball from enemy defenders. Contrariwise, since the defenders' role is to shut down the opponents' attacks, defenders' experience of flow was promoted in the following situations: free kick, corner kick, marking enemy strikers, and plays executed within the penalty area. Also, since defenders must keep their eyes on both the ball and the enemy strikers, they had more frequent experiences of flow than the other positions.

*"I suppose that must be because I had the sense of responsibility that I need to protect the ball I received in the attack zone. Since my place is important, I did what I had to do to feel the sense of responsibility I needed to have."*

Soccer player T

*"Crosses are difficult, and easier to experience flow in, and it's obvious that would be the situation when you experience flow... I need to keep an eye on the player I'm marking, but I also need to keep my eyes on the ball, and there are lots of cases when I lose my mark on the player, which means the opponent scores a goal..."*

Soccer player Q

#### 4. Discussion

The athletes' experiences of flow were categorized under three components: conditions, states, consequences, which correspond to the fundamental components of the IPO model of flow engine framework (Šimleša et al., 2018). The results of the current study show how the new components found in reflecting on the dynamic environmental contexts better explain the mechanisms by which athletes experience flow. Such results extended into sport-specific (soccer/golf) flow aspects originating from differences in game environments. Consequently, the current study offers new insights for understanding flow in sports based on new theoretical frameworks advancing on traditional theories, such as that of Csikszentmihalyi. Detailed discussions of these results are as follows.

First, in order to recall the experiences of flow in past games, interviews with the researcher were carried out, where the participants watched edited footage of the interviewee's performance that included both individual plays and media coverage of the game. This method was used as a process of measures to reproduce the recollections of athletes of the flow experience, which may be overly subjective and biased. Such approaches supplement the process of extracting unique personal experiences such as flow by promoting the interaction between researcher and participant and assisting their in-depth observation of their own experiences (Jackman et al., 2021). However, since the current study only utilized single interviews, there is a need for cross-examination and comparison through repeated interviews (Swann, Crust, & Vella, 2017). Experiences of phenomena can take novel forms through the interactions that occur during interviews (Creswell & Poth, 2016). Also, athletes who participated in the interviews provided an abundance of meaningful feedback through the member checks in the data analysis process, which made the researchers realize the need for additional in-depth interviews. Moreover, collecting quantitative data through questionnaires could usefully supplement the interviews and afford a more effective exploration of the multifaceted characteristics of flow.

More generally, the components of flow in sport appeared to conform to the traditional IPO model. In the conditions of flow, the input phase included the following: The skill-challenge balance perceived in the game environment, clear proximal goals, and its interaction process with immediate feedback. Starting from the traditional two-channel model, Csikszentmihalyi (1975) proposed that high levels of skill-challenge balance are a key factor of flow in goals, and this has been shown over time in the context of sports (Flett, 2015; Fullagar et al., 2013). This balance is evaluated through the supplementary process of clear proximal goals and immediate feedback,

which was also included as a prerequisite condition of flow in the IPO model (Šimleša et al., 2018). The novel contribution of the current study is that the contextual characteristic of game environment is part of the input phase, which reflects the dynamic nature of sports. Characteristics of goals are perceived through the social cognitive information processing processes; psychological environments—such as weather conditions, ground conditions, spectators, and opponent—affect the cognitive processes of athletes who participate in sports. Competitive sporting environments have been pointed out as affecting the cognitive processes of flow (Stein et al., 1995; Swann, 2016), but they have not received sufficient consideration in either the traditional model of Csikszentmihalyi or the newer model of Šimleša et al. Recently, Swann, Crust, and Vella (2017) utilized contextual variables to propose a model of optimal experience in sports and exercise contexts that includes experiences of flow. Similarly, the new model proposed in the current study takes a more comprehensive approach to the mechanisms of flow in sport by including factors such as game environment.

Also, readiness for competition has been newly identified as moderating athletes' balance between skill and challenge. The traditional concept of readiness meant the normal physical and or functional conditions that allowed athletes who experienced injuries—or treatment following said injury—to return to training and competitive environments, which determined the likelihood of return via clinical evaluations (Cheney et al., 2020; Webster et al., 2018). Here, psychological readiness was conceptualized as the psychological aspects athletes needed for recovery, such as confidence, expectation, and motivation (Conti et al., 2019; Podlog et al., 2015). Indeed, studies on the flow experience of athletes have discussed that the preparation (physical, mental, and competitive) as a factor influencing the occurrence of flow (Sugiyama & Inomata, 2005; Chavez, 2008), and identified an optimal level of readiness has an effect on facilitating the flow experience (Swan et al., 2012). The current study explored the readiness of athletes, including both the biological and psychological aspects, as a condition that allowed them to execute their skills to their maximum potential in normal competitive environments. Compared to the traditional concept of readiness that solely focused on athletes' recovery from injuries, this conceptualization expands the role of readiness as a variable for optimal psychological experiences. This discovery supports the worldview of positive psychology, which focuses more on optimal experiences like flow than on recovery from pathological states (Gould, 2002).

Also, the detailed classification of performance and outcome elements from the dimensions of goals and feedback is yet another point of interest in the input phase of flow. Šimleša et al. (2018) suggested that the type or con-

tent of goals can change according to the structure of a goal, but provided no details on the goal-feedback dimension. Clear proximal goals were identified as a major condition to flow (Csikszentmihalyi, 2000; Csikszentmihalyi & Nakamura, 2014), but the specific types of goals needed for flow were left undetermined. Recently, Swann Crust, and Vella (2017) proposed an integrated model of flow and clutch, which hypothesizes that different types of goals (open vs. fixed) can be individually related to experiences of flow. In the current study, the type of goals – differentiated into performance and outcome – interacted with corresponding feedback processes, as indicated in the athletes' experiences. Performance goals are related to the processes of attaining goals, and feedback about them reflects whether the athletes' performance meets their own expectations. Contrariwise, outcome goals are related to the results of goals, and feedback about them reflects whether the athletes are capable of surmounting their challenges (i.e., competition) in sporting environments. These different types of goals can affect not only the synchronization processes of athletes, but also the aspects of flow experienced by athletes (Weinberg & Butt, 2014). This multidimensionality provides a more dynamic explanation of goal-feedback interaction, which could also be said of the overall mechanisms of flow.

Next, we gained greater detail on attention and motivation – the components of core processes – through the addition of extrinsic motivation. The IPO model is based on a cognitive mechanism whereby fundamental attention processing determines the activation of flow: Automatic attention is the driving force that maintains this process. Similarly, based on the transient hypofrontality hypothesis, which proposes the interaction between two methods of attention processing based on skill-challenge balance, the results suggest that executive attention played a limited role; regarding the connection of motivation with attention, only automatic attention and intrinsic motivation were considered (Šimleša et al., 2018). This does not take into account the contextual characteristics of sports, where numerous changes take place during the interaction with the goal. In the context of sports, numerous pieces of information change dynamically and are simultaneously processed by the athlete, which necessitates flexible responses from the attentional focus that processes such situations (Tedesqui & Glynn, 2013). Also, the meta-cognitive strategies for such attentional focus control stress the importance of executive function (Brick et al., 2014). Considering the environmental context of dynamic sports, athletes must respond accordingly to changing situations and maintain flow or initiate a new flow (Fong et al., 2015). This means that the automatic attention process can sometimes be shaken. In order to maintain a flow state in this process, it is necessary to switch to an ex-

executive attention process. According to Dietrich (2004), willful control of the executive attention is a process by an explicit system that serves to buffer the imbalance between skills and challenges. This can be understood as a process of maximizing implicit performance through selective attention control. The current study gave ample consideration to the functions of executive attention in the process of athletes' experiences of flow, which led to the discovery of the roles of extrinsic motivation related to the activation of executive attention in the athletes' experiences of flow. The current findings show that extrinsic motives or rewards – controlled by the dynamically changing skill-challenge balance amid a competitive situation – initiate and promote the virtuous cycle of flow through processes of executive attention. Recently, Swann and colleagues (Swann, Crust, & Vella, 2017; Swann et al., 2019; Swann et al., 2017) proposed that the optimal experiences of athletes in sports are not limited to flow, but also include complementary states such as 'clutch'. Clutch is the psychological state of maintaining optimal performance under pressure through extreme perseverance and effort, which is similar to the functions of executive attention proposed in the current study. Therefore, the current results can bring new points of view to the existing flow literature, along with new views like the Swann and colleagues integrated model of flow and clutch.

Also, output as the result of flow included concepts like absorption, positive affect, and task achievement, which already have been explained in IPO model of Šimleša et al. (2018). Each of these components is a psychological phenomenon experienced by athletes in flow; they are the results of flow and also a motivation to reexperience flow, as stressed in Csikszentmihalyi's model (Csikszentmihalyi & Nakamura, 2014). The clear difference in the current study is that each output dimension of flow interacts with core processes of flow. Šimleša et al. proposed that the dimension of intrinsic motivation interacted with both positive affect and task achievement. However, the current study found that subcategories of core processes interact individually with different dimensions of the output of flow: positive affect with intrinsic motivation, and task achievement with extrinsic motivation. Intrinsic and extrinsic motivation, as defined by self-determination theory, are differentiated by quality rather than quantity; therefore, they each relate to different forms of reward-seeking behaviors (Ryan & Deci, 2000a, 2000b). Likewise, different types of positive affect perceived by athletes in competitive situations are related to intrinsic motivation focused on the goal itself, whereas task achievement – related to the outcome of goals – is related to extrinsic motivation. Furthermore, the feedback loop ( $O \rightarrow I$ ) that explains the mechanisms of the virtuous cycle in the IPO model also explains the cognitive process through

which athletes who have experienced flow reestablish their goals and reevaluate their skills, eventually seeking to reexperience flow.

Overall, the current results show that the IPO model of Šimleša et al. is a comprehensive explanation for the mechanisms of flow in sport, regardless of the type of sport. The novel components derived from athletes' experiences provide greater detail on the process of flow in the context of dynamic sports. Furthermore, the current study explores distinct characteristics (open vs. closed: skill / team vs. individual: game) of two different sports (soccer and golf) by recruiting athletes from said sports to identify different aspects of flow caused by characteristics specific to each sport. Such results add detail regarding the abstract quality of flow experience in sport. The critical differences appeared in the feedback loop and game environment.

In golf, like the traditional IPO model, the output of flow exerts an influence via input to strengthen core processes; in soccer, the output directly affects core processes in the feedback flow. This is due to differences in characteristics of the games. Golf is a discontinuous and individual game centered around closed skills, where the successful completion of a shot or a hole is followed by the next independent execution. Thus, the flow experience related to goals restarts with the end of an outcome and the evaluation of the outcome. However, soccer is a continuous team game centered around open skills, where athletes' plays interact dynamically with aspects of the game as long as the running time continues. Thus, the flow experiences of soccer players follow an instantaneous feedback route, centered around the core processes of flow. Also, in the game environments – classified as a contextual condition – there were differentiating characteristics reflecting sport-specific features. In soccer, a team sport, differences in positions – closely related to the functional roles for each player – could create differences in the aspects of flow experienced by individual players. In golf, an individual sport, characteristics of the course – which can exert meaningful impact on each shot – appeared as a variable that controlled athletes' experiences of flow. Such differences in game environment explain the individual differences of athletes participating in each sport. Further, the results imply that there can be differences in the details of flow mechanisms across conventional sports and highlight the need for follow-up research that addresses these issues.

#### 4.1 LIMITATIONS AND FUTURE DIRECTIONS

As with all studies, there were a number of limitations in this study. First, the current research focused on golf and soccer in order to distinguish the



different characteristics of these sports; studying more diverse sports can maximize the benefit of this approach. We chose a conventional classification (i.e., open vs. closed: skill / team vs. individual: game) of sports, but there are sports that combine such categories differently (e.g., MMA; open skill & individual game, bobsled; closed skill & team game). If the environmental differences between indoor and outdoor sports are also taken into account, sports can be categorized into much more detailed categories. In order to explore the detailed differences that appear across the context of conventional sports, follow-up research is needed that recruits athletes from much more diverse areas of sports. Second, the current research adopted the IPO model (Šimleša et al., 2018) as the theoretical framework for exploring flow in sports domain, but it must be borne in mind that this model was designed to explain more conventional goals. In order to compare the characteristics of flow, the IPO model needs to be applied to healthy non-professional athletes or non-physical tasks or goals. Future research could recruit participants for various goals, including sports, to compare and contrast different experiences of flow. Third, methods of the current study implemented to secure the objectivity of qualitative analysis can be further supplemented by the collection of quantitative data. To that end, measures and scales need to be developed to measure the prerequisites/conditions/outcomes based on the IPO model, which will then need to be validated. The discriminant validity of each dimension of the model can be the basis for evaluating the effects of mutual feedback routes, and the convergent validity of components can be the foundation for creating a theoretical framework (Swann et al., 2019).

## **5. Conclusion**

The current study conducted interviews using tools to encourage recollection (video footage of sports game) for the qualitative exploration of athletes' experiences of flow in sports. In the current study, the resulting flow experience was analyzed based on the theoretical framework of the IPO model, allowing the discovery of new components that supplement the traditional model in a way that supports a relationship with readjusted feedback routes. Results of the current study indicate new influences of the game environment that affect flow in the context of sports, identified readiness for competition as a variable that controls the skill-challenge balance, and suggest dimensions of performance and outcome that add more detail to the goal-feedback process. Also, the current study stresses the role of extrinsic motivation in explaining the dynamic relationship with core processes,

which implies that positive affect and task achievements interact with corresponding types of motives as an outcome of flow. Overall, the current study verifies that mechanisms of flow in sport are comprehensively explained by the logic of the IPO model. Furthermore, we determined that the aspect of flow can be differentiated by the distinct characteristics specific to each sport through the differences between feedback routes and game environment in the current study. Methodological issues have been discussed as limitations of the current research; the researchers look forward to future research that reflects these suggestions.

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