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Investigating in-performance transitions between mental states in high-level judoka using video-based stimulated recall

Bernadette Kellermann [a,*], Dave Collins [a,b], Alan MacPherson [a], Maurizio Bertollo [c]

[a] Institute for Sport, Physical Education and Health Sciences, University of Edinburgh, St Leonard's Land, Holyrood Road, Edinburgh, EH8 8AQ, United Kingdom
[b] Grey Matters Performance Ltd, United Kingdom
[c] Department of Medicine and Aging Sciences, University "G. d'Annunzio" of Chieti-Pescara, Chieti, Italy

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ABSTRACT

The Multi-Action Plan model offers an idiosyncratic, sport-specific, and applied framework categorising two peak (Type 1 & 2) and two non-peak performance types (Type 3 & 4). The purpose of the present study was to examine the transitions between these Performance Types across three competition-simulating training judo fights. After videoing three judo fights per participant, we interviewed six high-level judo practitioners (Md_{age} = 19 years) using video-stimulated recall. While watching their fights, participants indicated which Performance Types they experienced during each fight and, subsequently, discussed their experience with the lead researcher. Findings indicated that participants spent most time in effortful mental states (Type 2 & 3). Additionally, they identified currently not defined states 'between' current typologies, e.g., T2.5. Overall, participants reported more downthan upregulations. Specifically, they described downregulations as mostly uncontrolled and related to fatigue, technical-tactical, or cognitive-emotional transition cues. In contrast, they characterised upregulations as deliberate and proactive mental resets, utilising strategies such as self-talk. Lastly, we discussed our findings in relation to existing literature and offered implications for research and practice.

1. Introduction

Over the past decades, extensive sport psychology research has been conducted on optimal peak and suboptimal non-peak experiences of high-level athletes. Considering the often lengthy timespans of when athletes are required to perform against the high demands of the task at hand, it is realistic to expect athletes to experience several episodes of different mental states *during* their performance. However, there is a comparable paucity of literature providing scientists and sport psychology practitioners with evidence-informed guidance on how to best support athletes in navigating these transitions between peak and non-peak mental states. With this study, we set out to investigate what mental states athletes experience, and when and, crucially, why transitions occur between them. Specifically, we utilised the Multi-Action Plan (MAP) model (Bortoli et al., 2012) to investigate these questions in the context of high-level judo. The MAP model proposes idiosyncratic, sport-specific, and applied guidance on understanding and training human performance (Bortoli et al., 2012). In contrast to most previous concepts, the MAP model and its underpinning Multi-States Theory (MuSt) (Ruiz et al., 2020) offer a nuanced framework contextualising peak *and* non-peak performance experiences. Specifically, the MAP model characterises four distinct Performance Types (PTs), all differing on a cognitive (e.g., focus of attention and level of control), emotional (e.g., hedonic tone and functional impact), and behavioural level (e.g., level of resource recruitment and utilisation). Type 1 (T1) implies a minimally conscious, emotionally positive performance experience involving automatic movements. In contrast, in Type 2 (T2) performance, the performer successfully negotiates the onset of obstacles (e.g., fatigue) but experiences negative emotions. While T1 and T2 result in optimal performance, athletes experiencing Type 3 (T3) and Type 4 (T4) produce suboptimal performance. Specifically, T3 is characterised by ineffective resource recruitment, overfocussing, and dysfunctional and unpleasant emotions. Lastly, performers in T4 are unfocused, lack resources, and experience complacency.

Overall, T1 and T2 performance share some characteristics with related peak performance concepts such as flow state (Csikszentmihalyi,

* Corresponding author. Institute for Sport, Physical Education and Health Sciences, University of Edinburgh, St Leonard's Land, Holyrood Road, Edinburgh, EH8 8AQ, United Kingdom.
E-mail addresses: B.A.T.Kellermann@sms.ed.ac.uk (B. Kellermann), Dave.Collins@ed.ac.uk (D. Collins), Alan.MacPherson@ed.ac.uk (A. MacPherson), m.bertollo@unich.it (M. Bertollo).

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2014) and clutch performance (Schweickle et al., 2020). For a full review of MAP research undertaken so far and its links to related concepts, see Kellermann et al. (2022). Positively, and to date, MAP has produced detailed findings on *characterising* T1-4: Specifically, T1-4 was characterised by seven studies (e.g., Bortoli et al., 2012); T1-3 by two studies (e.g., Bertollo et al., 2015); and T1&2 only by Bertollo et al. (2016). However, *transitions* between PTs are yet to be investigated regarding the characterisation and timing of micro performance episodes, for example, a distinct duration of T2 experience followed by experiencing T3 during a performance event.

1.1. Transitions between mental states

In their seminal paper, Bortoli et al. (2012) proposed that athletes switch between PTs via two distinct coping strategies. Specifically, they describe five transition pathways via action- and emotion-focused coping. Action-focused coping implies that athletes (re)direct their attentional focus to core components crucial for effectively executing the task at hand (Bortoli et al., 2012). For example, they propose downregulation from T1 to T2 via action-focused coping, i.e., an athlete exits a flow-like T1 experience in favour of a more effortful mental state (T2) by deliberately directing their attentional focus to core components of their task. They also propose action-focused coping as switching strategies from T3 to T2 and T4 to T2. Importantly, however, empirical evidence supporting this hypothesis of Bortoli et al. (2012) is currently lacking.

Regarding emotion-focused coping, Ruiz et al. (2020) offer self-talk, arousal regulation, and imagery as possible emotion-focused coping strategies within MAP's underpinning MuSt Theory. For example, Bortoli et al. (2012) proposed emotion-focused coping during upregulation processes from T2 to T1 and T3 to T1; For example, an athlete might utilise self-talk to switch from an optimal but effortful mental state (T2) to a more flow-like experience (T1). While these are considered ideas, however, empirical research investigating such transitions is currently lacking, similar to the action-focused strategies outlined above. Therefore, we wished to investigate how athletes experience such transitions between PTs, specific to their performance context.

Lastly, regarding transition mechanisms, complexities become apparent when contextualising MAP's idea of 'switching' with MuSt Theory, which proposes that transitions occur on a continuum and extend the 2D representation of the MAP model into a 3D representation (Ruiz et al., 2020). For our study, and reflecting current MAP typologies, we suggest direction-specific language by describing transitions from higher-to lower-numbered performance types as upregulations (e.g., T3 to T2) and transitions from lower-to higher-numbered performance types as downregulations (e.g., T1 to T2). By introducing this terminology, we hope to indicate the overall trajectory of transitions and reflect the regulatory processes involved. Additionally, we would like to clarify that, throughout this manuscript, we will utilise the term 'Performance Type' (PT) when contextualising performers' experience with reference to the MAP model and the term 'mental state' as a concept-neutral term describing how performers make sense of a range of performance experiences.

1.2. Examining transitions in hyperdynamic sports

To date, MAP research has tested and corroborated T1-4 using self-paced sports such as dart throwing (Bertollo et al., 2013), shooting (Bertollo et al., 2016; Di Fronso et al., 2016), and golf (Wang et al., 2019); endurance sports such as cycling (Bertollo et al., 2015; di Fronso et al., 2018) and running (Vitali et al., 2019); and driving simulation (Filho et al., 2015) as a more externally-paced skill. Notably, however, all these are largely self-paced, closed-skill sports, except driving, which was, in any case, not ecological due to being performed on the simulator. Accordingly, to test the ecological validity and transferability of the MAP model, we wanted to investigate the experience of and transitions between MAP's PTs in judo, i.e., a less self-paced, dynamic, and open-skill performance context. Regarding transitions, we proposed investigating micro episodes of a judo training fight, allowing judo athletes (judoka) to simulate competition fights and extend their technical and tactical toolkits. Training fights last around 4 min, are highly dynamic, physically and mentally taxing, and usually consist of several fighting bouts (exchanges) performed standing or on the mat. Overall, judoka aim to achieve scores by successfully executing throwing, strangling, or grappling techniques.

1.3. Examining transitions between mental states in-situ

So far, researchers have utilised both qualitative (e.g., semi-structured interviews, for example, Swann et al. (2016)) and quantitative (e.g., Flow State Scale (Jackson & Marsh, 1996)) methodologies to examine peak and non-peak mental states. The existing body of MAP literature has consistently produced idiographic findings by choosing small samples (e.g., Bertollo et al., 2016) or case studies (e.g., Bertollo et al., 2013) to investigate idiosyncratic peak and non-peak mental states. Reflecting this approach, we investigated transitions between mental states using idiographic, event-focused, video-stimulated recall. Conducting event-focused interviews is an established method in the human high-performance context (e.g., Schweickle et al., 2021). It is used to gain in-depth, rich, and relevant information from athletes operating in complex performance contexts (Jackman, Schweickle, Goddard, Vella, & Swann, 2021). Specifically, three conditions must apply for an interview to be event-focused (Jackman et al., 2021); first, participants are recruited using specific inclusion criteria (in our study, high-level, early-career judoka); second, the interview is conducted soon after the activity (in our study, within 48 h); third, the purpose of the investigation is to elicit rich descriptions of the event (in our study, to conduct idiographic research on idiosyncratic performance experiences). Accordingly, we combined the event-focused interview with video-based stimulated recall using material collected prior to the interview as a stimulus for semi-structured interviews with participants. Considering the fast-moving and demanding nature of judo, we wanted to provide participants with a stimulus that allows them to narrate and evaluate their performance against MAP's four PTs. We adopted an overt research approach (cf. Whyte, 1984), allowing the lead researcher to step into the world of judo while openly communicating the rationale and aims behind this research. Further, by providing video as the stimulus for our interviews, we hoped that participants had not just a memory aid but a tool to debrief their performance on a metacognitive level. Previous research has explored the role and methods of observation in an applied sport psychology context (Holder & Winter 2017). In the present study, we adopted a formal approach to observing and tracking mental states (i.e., MAP's PTs) by interviewing high-level judoka. Video-based stimulated recall has previously produced in-depth sport research, considering the practical challenges of eliciting complex information from participants in naturalistic dynamic settings (e.g., Mackenzie & Kerr, 2012).

1.4. The present study

Therefore, reflecting these issues, our purpose was to investigate transitions between mental states in situ and in a dynamic sport. Specifically, we investigated transition processes between micro episodes during each fight. Overall, we examined 18 competition-simulating training fights (three fights of each of our six participants). We addressed three research questions: First, what PTs and transitions do participants experience across a dynamic performance event, namely, a competition simulating training fight? Second, what performance downregulations do participants experience? Third, what performance upregulations do participants experience, and against these experienced PTs, how do they maintain optimal mental states?

2. Material and methods

2.1. Study design

Extending previous MAP research, we adopted an idiographic approach (e.g., Bortoli et al., 2012; Filho et al., 2015). Given the novelty of our research questions, coupled with the hyperdynamic and complex nature of judo, we deliberately recruited a small sample of participants who generously provided us with information-rich and in-depth insights into their idiosyncratic performance experiences. This aligns with existing idiographic MAP research conducting research with small samples (e.g., Bertollo et al., 2016) or even case studies (e.g., Bertollo et al., 2013). Reflecting this, we aimed to provide scientific and applied guidance *only* related to the six judoka who participated in the study. Therefore, we adopted a pragmatic approach considering both the specific and broader applied concerns of sport psychologists and their clients (Giacobbi et al., 2005). Within an applied sport psychology context, pragmatism aims to provide an application-driven research paradigm by meaningfully uniting academic research and applied work by practitioners (Giacobbi et al., 2005). On an ontological level, pragmatism offers flexibility and rejects a single truth or reality (Giacobbi et al., 2005). We developed this protocol specifically for the present study. However, applied sport and performance psychology practitioners might find our protocol helpful because it prompts athletes to highlight crucial cues for down- and upregulation, thus giving important insight into how performance could be optimised. Therefore, applied practitioners might consider integrating this approach into their work, for example, as a performance debriefing tool.

2.2. Participants

We recruited six high-level British junior judoka ($Md_{age} = 19$), two identifying as female (P1, P2) and four as male (P3-6). All participants reported extensive national experience and three to five years of international competition experience, representing four weight categories overall. According to McKay et al. (2021) guidelines, all participants can be categorised as elite/international (Tier 4) athletes due to competing on an international level for several years. We approached one of their coaches as a gatekeeper and subsequently, with his advice, recruited six judoka through a combination of convenience and purposeful sampling. The recruitment process consisted of open and transparent conversations between the lead researcher, the gatekeeper, and eventual participants based on willingness to participate, availability considering their training and competition schedule, and full physical health to participate in the competition-simulating fights. These conversations were conducted in person and at their training facility; the lead researcher emphasised throughout that participation was entirely voluntary. Additionally, the lead researcher provided all potential participants with informed consent sheets. All six athletes initially recommended by the coach were willing to participate, available, and physically healthy, but were given one week to decide if they want to participate. All participants confirmed their willingness to participate after this date and were formally recruited by the lead researcher for our study. Before participating in the research protocol, each participant was provided with an information sheet outlining the purpose and process of the study. Participants then provided written consent prior to taking part. All procedures were performed in compliance with relevant laws and institutional guidelines. Ethical approval was granted by the University of Edinburgh Ethics Sub-Committee (21.12.2021, Ref: BKEL19102021).

2.3. Procedure

We developed a semi-structured, video-based stimulated recall protocol. After piloting the protocol with one (not participating) athlete, the lead researcher made minor logistical adjustments, mainly concerned with the efficient execution of the research protocol.

After providing written consent, the lead researcher introduced each participant to the MAP model. Each PT, as currently defined, participants were offered an in-depth explanation and any open questions were addressed. To minimise the risk of 'shoehorning' participant experiences, we encouraged participants to utilise MAP's typologies critically and discuss any doubts with the lead researcher when they struggled to describe their performance experiences using the MAP typologies. Subsequently, the lead researcher videoed three training fights of each participant (a total of 18 distinct events) across a total of six training sessions. The training sessions followed their usual structure including warm-up, training fights, and cool-down and lasted a maximum of 90 min. Fights were recorded using a JVC Video Camera 004 and lasted between 01:33 and 04:40 min. The tripod with the camera was placed outside the training areas to avoid any intrusion. It is important to note that, due to the training setting, participants were fighting teammates whose technical and tactical idiosyncrasies they were familiar with to some extent. We deliberately chose to film training fights for this research, as our study is, to our knowledge, the first to explore transitions between mental states in judoka in situ. However, as they shared with the lead researcher, an important contextual consideration is that judoka did not necessarily try to win every fight but also consolidate or experiment with tactical and technical aspects of their craft. However, most fights had a similar duration to standard competition fights.

Once complete, each participant attended two individual meetings. First, and within 48 h of videoing their fights ($M = 20h\ 25$ min post-event), an in-person appointment with each participant at their training facility, lasting between 15 and 20 min. This timeframe is consistent with previous research exploring peak performance mental states through event-focused interviews, e.g., Schweickle et al. (2021). At the start of the meeting, the lead researcher provided a printed, simplified MAP figure outlining all PTs, including four critical characteristics of each PT. Participants received a pen and three paper documents – one for each fight - containing an empty MAP model where only the four PTs were outlined. Subsequently, the lead researcher again explained the key elements of the MAP model. Participants were then instructed to watch each video on the laptop and annotate their perceived PT in the relevant field with an 'x' indicating which PT they experienced. After the lead researcher answered the participants' questions, participants followed this protocol and watched each fight, noting down respective PT episodes. Simultaneously, the lead researcher stated the exact timestamps of each PT episode and transition.

The second meeting discussed participants' PT profiles for each fight. Meetings conducted online via Teams and within two weeks of the first meeting ($M = 8d\ 19h$ post-fight), lasted between 19 and 47 min ($M = 32.33$ min) and were recorded for analysis. The lead researcher followed a semi-structured, conversational format, asking participants about when and crucially why transitions had occurred. She paused the video at each transition timestamp and asked participants to clarify how and why the transition occurred, i.e., 'Can you explain to me why this is an important point in the performance to you?', 'Why did you note down this PT for this part of the fight?'. Once all PT episodes and transitions were discussed, the lead researcher summarised participants' responses and checked if they agreed with this summary. One participant changed one PT appraisal; all others were approved.

2.4. Data analysis

Overall, two types of data were collected. First, timings on when PTs and transitions occurred and second, qualitative reports of why they occurred. Regarding timing data, the lead researcher organised all handwritten notes into tables pertaining to each participant, detailing the duration of each PT episode and all associated transitions. Subsequently, a complete data set table was created, summarising aspects including the number of T1-T4 phases, time spent in each PT, and the number and types of transitions identified. Where appropriate,

descriptive statistics were calculated.

Regarding the qualitative recall data, we adopted interpretative phenomenological analysis (IPA) because it allows for idiographic, in-depth within-case analysis and tentative cross-case analysis. The first author conducted data analysis, following Smith et al.'s (2022) six-step IPA protocol. Experiential Statements, Personal Experiential Themes, and Group Experiential Themes (GETs) were iteratively checked by the second and third authors in meetings and calls. After those critical discussions, minor adjustments were made regarding interpretative layers and linguistic improvements.

2.5. Trustworthiness

Importantly, all judoka agreed to participate in member reflections in individual online meetings, which were conducted within eight weeks of the second data collection meeting and lasted between 20 and 37 min. Member reflections are conversations between the researcher and participant to discuss the findings and address any gaps or open questions, for example, in relation to analysis and interpretation (Smith & McGannon, 2018). They are a useful tool that gives participants ownership over how their complex experiences are presented in the report and enhances transparency throughout the analysis process. In our study, the lead researcher shared their personal data set with the participants and presented the study findings. All engaged in critical discussions and had the opportunity to amend, delete or add any information to their data set. Two participants made minor adjustments to their PT appraisal in one of their fights; all others approved of the findings. Subsequently, the lead researcher sent each participant their personal data set and overall study findings. Participants were then given an additional two weeks to make any further amendments. No further changes were made. Lastly, the lead researcher critically discussed an executive summary of the (anonymised) study findings with the judokas' coach, who supported the study findings.

Additionally, the lead researcher kept a reflexive diary, recording observations during data collection and analysis as they occurred (Mays & Pope, 2000). The purpose behind this measure was to record reflexive notes and observe any research tendencies impacting data interpretation (Hill & Dao, 2021). Specifically, she noticed that some participants articulated vital points well, whereas others implied the same meaning without the same linguistic precision. Throughout the analysis process, the first, second, and third authors engaged in an iterative process between analysis and critical peer debriefs. These conversations were focused on situating our findings within the wider MAP and sport psychology literature, while also discussing each analysis step as a group. Additionally, an increased effort was made to apply fair dealing throughout the analysis process, i.e., equal consideration of all participants, ensuring that findings reflect the experiences of all six (Mays & Pope, 2000). However, for the purpose of this manuscript, we selected the most poignant quotes to highlight the key findings of our study with regard to our research questions. Reflecting this, we acknowledge that this may not present a precisely equal split of quotes across participants in this report.

3. Results

Each participant analysed three randori fights (18 fights in total), lasting between 1:33 min and 4:40 min (Md = 3:47 min) (Table 1). Values were calculated for each participant; for example, P1 identified 13 PT phases across three fights, three T1 phases, five T2 and T3 episodes, and zero T4 phases. Subsequently, descriptive statistics were calculated across the sample.

Participants reported at least six and a maximum of 12 transitions across three fights (Md = 9). All transitions were linear, e.g., T3 to T2, except one T4 to T2 upregulation (P3), which was the only upregulation from T4. Overall, participants reported a higher number of downregulations (Md = 6.5) compared to upregulations (Md = 2.5) (Table 2).

Table 1
Performance Types, as identified by participants.

Description	Mean	Median	Standard Deviation
PT phases, total:	12.5	12.5	2.35
of which were T1:	2.5	2.5	0.55
of which were T2:	5.33	5	1.63
of which were T3:	3.17	3.5	1.47
of which were T4:	0.33	0	0.52
Time spent in T1:	150.17s (2:30 min)	147.5s (2:28 min)	92.07s (1:32 min)
Time spent in T2:	307s (5:07 min)	299s (4:59 min)	67.46s (1:07 min)
Time spent in T3:	147.33s (2:28 min)	159s (2:39 min)	97.71s (1:38 min)
Time spent in T4:	12.5s	0s	26.03s

Note. Overview of the PTs identified, and the time spent in each PT.

Table 2
Transitions between Performance Types, as identified by participants.

Type of transition	Range	Median	Participant reports
Number of upregulations	0–3	2.5	Reported by 5 of 6 participants.
T4 to T2	0–1	0	Reported once by 1 participant.
T3 to T2	0–2	1.5	Reported by 5 of 6 participants.
T2 to T1	0–2	0.5	3 participants did not report T2 to T1. 2 participants reported one occurrence. 1 participant reported two occurrences.
Number of downregulations	3–8	6.5	Reported by all participants.
T1 to T2	2–3	2.5	Reported by all participants.
T2 to T3	0–5	3.5	Reported by 5 of 6 participants.
T3 to T4	0–1	0	2 participants reported one occurrence.

Note. Overview of the up- and downregulations identified by participants.

The lead author produced six Group Experiential Themes (GETs) through IPA analysis, which are presented in the following sections.

3.1. GET 1: Most time spent in T2 & T3

Participants predominantly experienced T2 and T3. P1 explained: "Most practices span across T2 and T3 … I find it difficult to distinguish between those two … T1 and T4 are extremes … T1 is perfect performance, and T4 is really a just 'lost it'- kind of performance." Specifically, participants perceived T2 as optimally challenging, e.g., negotiating fatigue onset and demanding tactics from the opponent. As a result, scoring becomes increasingly tricky. However, they also emphasised that dealing with those obstacles well by regaining mental focus and adjusting their fight plan effectively would feel rewarding to them. P5 explained: "Although I'm really having to work hard, I'm not winning the exchanges … I think that's why T2 is more rewarding to me … I'll be fighting against challenges, but I'm doing well in them."

In contrast, participants categorised more challenging episodes of the fights as T3, particularly in relation to their opponent gaining a tactical advantage over them. For example, P6 explained: "I went straight to Type 3 because it was a bit 50:50, and then, just 5 s later, he [opponent] just had the grips that he wants. He was dominating from the get-go. Even if I'm trying, putting in a lot of effort, it still wasn't optimal." However, participants emphasised that despite these obstacles, they still perceived T3 as a state with the potential of regaining control. P4 concluded on one of their fights: "I was getting beat but I wasn't getting ragged on, not getting destroyed. I was still in it a wee bit

as you can see, I was still in the contest but then he [opponent] ended up winning."

3.2. GET 2: PTs as spectrum

Participants sometimes struggled to differentiate between distinct PTs: "It's more like a spectrum … It's difficult to pinpoint … where exactly the border is." (P1). They added that, at times, "[my] physical T1-4 and my mental T1-4 don't always coincide with each other … I'm going into the next exchange with a real mental clarity and focus … but my body is feeling really tired." Semantically, five participants identified states 'between' currently defined PTs, using terminology such as "*between* T2 and T3" (P4), "*low* T2" (P1), or "T2 *borderline to* T3" (P1). Further, two participants reported fluctuating episodes between PTs (P1 and P6 reported three fluctuation episodes: one T1&2, one T2&3, and one T3&4). Overall, they struggled to differentiate T2 and T3. For example, P1 identified feeling "close to the boundary between 2 and 3 in terms of what my intention was". Further, P6 illustrated that fluctuating between T2 and T3 was linked to technical (i.e., gripping) momentum during a fight:

"[when] I can get the grips I want, I float higher up to T2, but then the grips get ripped off, so it goes back down, then he [opponent] gets his grips, so it goes further down towards T3, and then his grips come off, and it goes back to T2 … It never fully reaches T2, and it never fully reaches T3".

3.3. GET 3: Overall fight dynamic

Participants started most fights in T1, except for highly fatigued starts in T2 towards the end of a practice session or when fighting opponents from higher weight categories. T1 starts, at least in part, may be due to the randori (practice) context. P6 explains: "In randori, it's a bit easier because we train with them [opponents] all the time … We know what we're expecting … First exchanges are never going to be … full on from the start." Participants characterised these T1 episodes as "quite comfortable" (P2) with a clear focus, only minor fatigue, optimal motor control, high perceived tactical control, and high self-efficacy. However, such T1 episodes appeared to be of relatively short duration, with the intensity and difficulty of the fight increasing, as P4 anticipated: "I probably knew it would be getting tougher after this first exchange because he [opponent] comes back hungrier".

Moreover, participants reported often finishing fights in T3, sometimes in T2, rarely in T4, and never in T1. All reported enduring extreme fatigue towards the end of a contest, both physically and mentally, as P1 illustrated: "That last minute of a contest is very difficult because either way, your brain starts playing tricks on you a little bit, and that's when it's really easy to get distracted or switch off." Additionally, participants characterised such T3 episodes with a crucial loss of mental clarity (focus, concentration), negative self-talk, getting out-gripped by their opponent, and attempting last-ditch efforts instead of calculated attacks.

Lastly, participants only described very few experiences in T4. Those occurred when they experienced the complete depletion of physical and mental resources. P1 explains: "It's very, very rare that I go into 4 in training … There are occasional, very brief moments of Type 4, …so brief to the point of like 1 s … It's not even like a conscious reaction."

3.4. GET 4: Downregulation pathways

Generally, participants described downregulation as involuntary and uncontrolled. They presented most transitions as gradual ("drifting" according to P5), with only some occurring suddenly. P1 extended this notion and explained: "I think the change happens quite gradually, but I'm only aware of it suddenly."

Participants characterised T1 to T2 as transitioning from (relatively) effortless to effortful fighting against their opponent. In these scenarios, participants appeared to exert more effort to maintain optimal performance and, importantly, prevent further downregulation. T1 to T2 downregulations were characterised by fatigue onset, short phases of the opponent dominating but participants regaining control, and more defensive gripping. P6 described: "The moment he [opponent] started getting his grips, …that's when I have to fight to get them off and actually start to put a bit more effort in to get the outcomes I want." Additionally, participants emphasised that, as they are negotiating fatigue, motor control gradually deteriorates while mentally, they still focus well: "In my brain though, I still feel in control, but my movements are losing a bit of control." (P1).

Regarding T2 to T3, participants reported a general decrease in fight pace. While judoka exerted more effort into tactical decision-making, counterattacks appear slower, more defensive, and less precise than in optimal PTs. Therefore, the judoka struggled to fight proactively. P6 illustrated: "That was like a Hail Mary. I'm getting dominated … It's not an actual, worked-out attack, if that makes sense." As a result, opponents may win exchanges, which worsens tactical momentum for them. Overall, participants reported losing mental clarity and their ability to focus while also struggling to perform well motorically. P2 explains: "I'm a lot slower movement-wise, and again, even my attack is slow … And I'm getting up a lot slower."

Regarding T3 to T4, participants reported actively disengaging from the fight. P2: "I'm actually like holding back from gripping up and going forward … I've also admitted defeat a little bit … I'm just letting her [opponent] control the fight." Specifically, participants underlined their sense of withdrawal by deliberately prolonging the pauses between exchanges and employing defensive, passive tactics.

3.5. GET 5: Downregulation cues

Participants identified three categories of downregulation cues: fatigue-related, technical-tactical, and cognitive-emotional. Downregulation was reportedly caused mainly by technical/tactical and fatigue-related cues. Participants identified mostly single cues to cause transitions. However, five participants also reported that cues combining multiple categories would trigger transitions. Specifically, combinations between fatigue-related and cognitive-emotional, with tactical/technical cues, were frequently identified.

Regarding fatigue-related cues, participants linked T1 to T2 transitions to the onset of physical and mental fatigue. P5 reportedly "drifted" from T1 to T2, underlining the uncontrolled nature of the transition. Further, participants recounted repeated fatigue-induced concentration lapses and extreme physical exhaustion in the context of T2 to T3 and T3 to T4 transitions. Specifically, participants highlighted that allowing this fatigue to affect their emotions and mental composure would result in suboptimal performance.

Regarding technical-tactical cues, participants emphasised that rapidly shifting fight dynamics resulted in downregulations. P3 concluded: "The pace dropped, and I stop[ped] being as aggressive and putting in as many attacks, and I get thrown because of it." Specifically, scenarios in which the opponent had more effective grips or even throws the judoka implied an unfavourable change in momentum. P4 explained: "I'm still trying to attack him, but my attacks are failing. He's just defending them [attacks] better, his grips are getting better … I'm seeing him do wee things that I'm not doing."

Lastly, participants identified cognitive-emotional cues for downregulation, such as frustration, concentration lapses, or lack of perceived control. Precisely, frustration towards the opponent (e.g., not fully engaging in the fight) and perceiving that exerted efforts would not lead to a score. Sometimes, participants even reported combining those cues with fatigue-related aspects. For example, P2 explained: "I'm getting tired and probably a little bit frustrated … I'm letting the frustration affect me."

3.6. GET 6: Upregulation processes

In contrast to downregulations, participants experienced upregulations as deliberate and predominately gradual. They identified T3 to T2 most commonly. In these scenarios, they aimed proactively to (re)gain clarity and control over the fight and score.

Overall, participants reported cognitive-emotional cues more frequently than tactical-technical (rarely) and fatigue-related cues (not reported). Specifically, participants experienced gradual upregulations after regaining tactical and mental control or deliberately feeling aggressive. P6 explained: "It's not straight, like 'Oh, I'm going straight back into dominating'. It's slowly, each time we're gripping up, it's slowly a bit more 50:50." However, sudden upregulations occurred mainly after the judoka achieved a score. Extending this, some participants also experienced upregulation 'spikes', i.e., short and sudden bursts of experiencing T2 but immediately returning to T3. P6 explained: "I went for a split second into Type 2 because this is where I started to kind of lead and then dropped off instantly."

Participants identified self-talk as a crucial upregulation strategy, aiming to increase motivation, shift the fight momentum back into their favour, and increase their self-efficacy. P2 explained: "If I get a good score, I feel I can bounce back and go back to optimal, and I'm quite clear about what's happening."

Interestingly, participants identified that upregulation often occurred in the short time between exchanges, where both judoka get up from the mat and reset before the following exchange. Specifically, with short inner monologues, they aimed to reinforce specific strategic intentions and their fight plan. P5 described such debriefs as "giving yourself a kick". Importantly, this mental reset must happen quickly to demonstrate and project readiness to the opponent and referee.

3.7. Summary: Individual performance profiles

Lastly, we created detailed, idiographic performance profiles for each participant, summarising information relating to the timing and duration of PT experiences as well as indicating the cue and degree of graduality of transitions. P3, for example, showcased a full range of PT experience (Figure 1). Overall, the performance profiles visualise the idiosyncratic nature of the performance experiences discussed. For example, P5 reported only fatigue- and cognitive-emotional transition cues, in contrast to P6 who did not report any fatigue-related transition cues at all. Further, P2 only identified gradual downregulations, with no acute transitions or upregulations present at all. The performance profiles pertaining to all other participants, as well as a detailed figure key, can be found in the Supplementary Materials of this article.

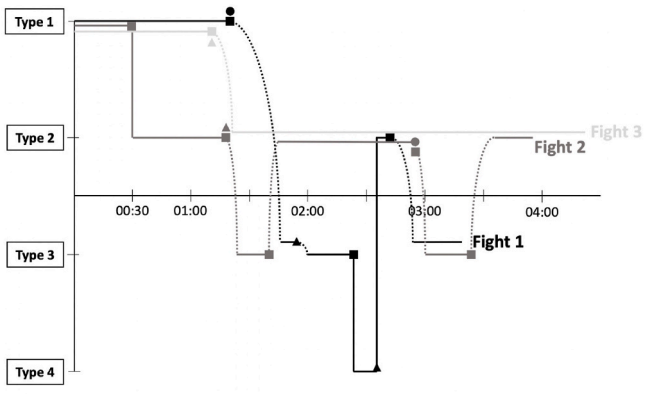

Figure 1. Performance Types and Transitions, as experienced by P3.
Note. Idiographic profile of Performance Types and transitions experienced by P3 across three judo fights. Squares represent a technical or tactical cue; circles represent a fatigue-related cue; and triangles represent a cognitive-emotional cue. A detailed figure key can be found in the Supplementary Material section.

4. Discussion

The purpose of this study was to investigate transitions between mental states as micro within-performance episodes across three randori fights by six high-level judoka. Our findings extend current MAP research by providing specific and idiographic evidence on down- and upregulation pathways and processes. Specifically, we found that participants spent the most time in T2 and T3 and often experienced overlap between the currently defined characteristics of those states. Overall, participants more frequently experienced downregulations compared to upregulations. In this study, we addressed three research questions. In the following, we will critically discuss our findings pertaining to each question against existing literature and provide directions for future research and practical recommendations.

4.1. What PTs and transitions do participants experience across a dynamic performance event, namely, a competition simulating training fight?

4.1.1. More of T2 and T3, less of T1

Participants reported experiencing all PTs but spent most time in highly aware, effortful PTs (i.e., T2 & T3). Accordingly, participants reported very few instances of T1 and T4. They also perceived T1-T4 on a spectrum rather than as distinct mental performance states. These are novel findings, extending existing MAP literature on several levels. First, our findings offer empirical insights into the timing of when high-level athletes experience specific PTs during a performance event. The current body of MAP research has yet to produce any findings on time spent in respective PTs during a performance event.

Second, participants most consistently experienced T1 at the beginning of fights – later, only rarely or in short episodes. T1 shares several characteristics with experiences widely considered the pinnacle of human performance, such as flow state (Bortoli et al., 2012) (Kellermann et al., 2022). Reflecting this, MAP research has characterised T1 (among other aspects) with movement automaticity and optimal recruitment *and* utilisation of physical and mental resources (Bortoli et al., 2012). However, our participants often gradually transitioned from T1 to T2 relatively soon after the beginning of the fight, as task demands increased and fatigue built up. This transition from (at least mostly) automatic movement control of T1 to more controlled movements reflects previous literature offering automaticity as a gradual concept (Carson & Collins, 2016). However, it contradicts early MAP research suggesting that participants 'switch' from T1 to T2 (Bortoli et al., 2012).

Additionally, performers often experience flow state with open goals in mind when exploring novel stimuli and experimentation (Swann et al., 2017). However, our participants emphasised that the fights discussed in our study had the function of competition simulation or embedding newly learnt techniques. This fatigue-inducing context requires total concentration, awareness, and high motor control. Therefore, we suggest that a T2-like mental state appears to be optimally suited for hyperdynamic performance contexts such as judo, as opposed to flow-like T1 experiences.

4.1.2. Gradual and acute transitions between PTs

We offer insight into the experience of and transitions between PTs in judo, i.e. an open-skill and hyperdynamic performance context. MAP research so far has investigated PT characteristics in the context of self-paced activities such as shooting (e.g., Robazza et al., 2016), endurance tasks (e.g., Vitali et al., 2019), and driving simulation (Filho et al., 2015). However, combat sports such as judo present a hyperdynamic environment, demanding that judoka adapt quickly to sudden changes in the performance environment, i.e., the conscious (and effortful) processing of and deliberate adaptations to fight dynamics (Lesiakowski et al. (2013), Voss et al. (2010). Reflecting this, participants experienced frequent down- and up-regulations between PTs. Specifically, they

described a transition mechanism consistent with ideas proposed by some MAP research (e.g., Bortoli et al., 2012; Robazza et al., 2016). More frequently, however, participants described gradual transitions similar to those proposed by MuSt Theory (Ruiz et al., 2020). In summary, we suggest that athletes engage in both acute and gradual transitions, depending on the purpose and intended outcome of the transition.

4.2. What downregulations do participants experience?

Overall, participants reported more downregulations (i.e., transitions from a lower-to a higher-numbered PT) than upregulations (i.e., transitions from a higher-to a lower-numbered PT). Within that, the number of downregulations and the overall trajectory of each fight was highly idiosyncratic. For example, and presenting an extremely idiosyncratic finding, one participant (P2) reported a comparatively pessimistic PT profile containing only gradual downregulations. Often, downregulations were not followed by upregulation processes, suggesting an increasingly suboptimal performance experience as the fight progresses. Specifically, participants reflected notions of existing research suggesting that such negative psychological momentum would be exacerbated by decreasing self-efficacy (Shaw et al., 1992), resulting in suboptimal performance due to a perceived inability to deploy recovery strategies.

Further, participants expressed having little to no control over downregulation processes. However, and this is a significant implication of our findings, some participants reported an ability to predict (but not necessarily prevent) downregulations, particularly relating to their opponent's tactical and technical behaviour. Previous research identified such anticipatory skills as a crucial characteristic of champion judoka (Piras et al., 2014). Therefore, we suggest that training the ability to detect idiosyncratic downregulation cues presents a crucial skill to 'break the cycle' of back-to-back downregulations.

Extending this, our findings suggest that fatigue-induced and cognitive-emotional downregulations might be, on an idiosyncratic level, more predictable and, therefore, more manageable to accomplish compared to technical-tactical cues by the opponent. For example, participants reported an ability to predict fatigue levels depending on the opponent or time of day and allocate resources accordingly. Similarly, cognitive-emotional downregulation cues such as organic negative self-talk might be a (to an extent) predictable stress response. Moreover, existing research suggests that the resulting coping strategies after such organic self-talk depend on whether the athlete perceives to have sufficient resources to meet task demands (Sarig et al., 2023) – an interesting parallel to MAP's characteristics across typologies.

4.3. What upregulations do participants experience, and against these experienced PTs, how do they maintain optimal mental states?

Despite describing a greater number of down-than up-regulations, participants reported a small number of consistent and specific upregulation strategies. Crucially, and in contrast to downregulations, upregulations were characterised by a deliberate and proactive effort of optimising performance. In short, while downregulations were associated with a degree of passivity and uncontrollability, participants described specific cognitive-emotional upregulation processes to (re) gain control over their performance, e.g., deliberate focus on core components, regaining clarity over the fight dynamics, anticipating opponent behaviour, and engaging in motivational self-talk.

Specifically, regarding upregulations from T2 and T3, our findings are consistent with early MAP literature hypothesising that athletes operationalise combinations of action- and emotion-focused coping (Bortoli et al., 2012). Bortoli et al. (2012) also hypothesised upregulations from T3 to T1. However, our participants did not describe such transitions. Similarly, Bortoli et al. (2012) suggested action-focused transitioning from T4 to T2. However, only one participant described one such transition – simultaneously, it was also the only non-linear transition, i.e., it skipped the neighbouring PT. Considering this is the first empirical study investigating transitions between PTs, we recognise that future research is needed to investigate transition pathways more in-depth to provide insight into to what extent participants may also skip PTs during transitions.

4.3.1. Maintenance of optimal performance as a dynamic process

To date, MAP research has produced excellent findings on a multilevel, distinct categorisation of T1-4 (Kellermann et al., 2022). Crucially, however, a novel finding of our study regards states 'in-between' MAP's currently defined typologies – a topic which, so far, has not been investigated in MAP literature. Participants identified several nuances between T2 and T3 but simultaneously experienced those effortful states the most while negotiating complex fight dynamics. Therefore, we tentatively suggest that maintaining an idiosyncratically optimal performance may be associated with simultaneously preventing downregulation into less optimal mental states. Unfortunately, empirical research surrounding this topic is currently lacking. Therefore, more research is needed to examine the effective maintenance of optimal performance critically.

4.4. Limitations

A significant challenge for the present study was its idiographic nature, which is simultaneously a great strength. Notably, while some general tendencies could be detected, participants produced a great variety of findings. However, the idiosyncratic nature of the performance experiences discussed becomes clear when considering, for example, that one participant only reported gradual downregulations, one participant did not report any fatigue-related transition cues, or one participant identified a single non-linear (T4 to T2) transition. In short, while this range of findings might appear inconsistent at first, this diversity in responses highlights the complexity of human performance and the non-generalisable nature of the data presented in our study.

Further, logistical pressures due to the participants' busy schedules affected the timing of some elements of this study. For example, conducting the stimulated recall interview of all fights within 24 h might have elicited more detail in participant descriptions. Further, although we did not observe participants experiencing any memory issues regarding their fights in the second meeting, it would have been better to conduct the semi-structured interviews as part of our second meeting sooner than the targeted two-week timeframe. Similarly, member reflections were conducted up to eight weeks after data collection due to time and access limitations, which, despite efforts by the research team, might have resulted in less in-depth discussions than conversations closer to data collection dates as recommended (see Smith & McGannon, 2018).

4.5. Implications for research and practice

This study investigated transitions between mental states in high-level, early-career judoka. Future research is needed to contextualise our findings with the experiences of highly experienced, champion-level judoka to investigate commonalities and differences in the experience of and transitions between PTs. Further, our findings are situated within a training, competition-simulating performance context involving (comparatively) lower stakes. Therefore, research is needed to investigate the experience of and transitions between MAP's PTs in a high-stakes, high-pressure competition setting.

Second, our findings suggest a degree of predictability of downregulation cues. Accordingly, research is needed to offer guidance on how coaches can train athletes to predict and detect downregulation cues and manage downregulation results to prevent adverse psychological momentum leading to further downregulation. Further, applied sport and performance psychology practitioners might benefit from

utilising and adapting our approach in their own practice, for example, as a debriefing tool. Specifically, practitioners might utilise this approach to create a common language among athletes and coaches regarding transition cues, as well as recovery and maintenance strategies. Simultaneously, practical guidance is needed on idiosyncratically developing strategies to strengthen upregulation. For example, while organic self-talk is considered under-researched (Sarig et al., 2023), research indicates that self-critical self-talk may increase cognitive performance by increasing internal motivation (Kim et al., 2021). Such increased cognitive performance may result in detecting tactical opportunities more effectively to optimise performance.

5. Conclusion

In summary, our findings suggest that judoka experience numerous transitions between mental states during a performance event. They also tend to spend more time in overall effortful mental states (i.e., T2 & T3). Transition cues and processes often depend on the transition's direction, purpose, and intended outcome between mental states. Considering the judo environment's hyperdynamic nature, our findings offer idiographic results on how athletes negotiate such a demanding performance environment.

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Given their role as member of the Editorial Board, Maurizio Bertollo had no involvement in the peer-review of this article and has no access to information regarding its peer-review. Full responsibility for the editorial process for this article was delegated to Prof Markus Raab and Prof Katherine Tamminen.

CRediT authorship contribution statement

Bernadette Kellermann: Writing – original draft, Visualization, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Dave Collins:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Conceptualization. **Alan MacPherson:** Writing – review & editing, Supervision, Project administration, Methodology, Conceptualization. **Maurizio Bertollo:** Writing – review & editing, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.psychsport.2024.102701.

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